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THE TRANSPORTATION AND HANDLING OF GRAIN BY MOTORTRUCK IN THE SOUTHWEST

UNITED STATES DEPARTMENT OF AGRICULTURE
PRODUCTION AND MARKETING ADMINISTRATION

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The study was conducted under the authority of the Research and Marketing Act of 1946.

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SUMMARY

For a study of the transportation and methods of handling grain by motortruck in the three Southwestern States of New Mexico, Oklahoma, and Texas, data were collected from 117 business concerns handling an estimated 30 to 35 percent of the grain grown in this area. The data indicated that 77 percent of the respondents used motortrucks along with railroad facilities for shipping and receiving grain. None of them used trucks exclusively in their business operations, but 23 percent stated that all their transportation was provided by the railroads. Analysis of the data by type of business operation indicated that 71.4 percent of country elevators, 69.2 percent of terminal elevators, 100 percent of flour mills, and 91.7 percent of feed mills used trucks to some extent for the inbound or outbound shipment of grain or both in 1950.

Although 90 of the 117 concerns stated that they used motortrucks in the conduct of their business, only 77 of them indicated the proportion of the total amount of grain handled on an annual basis that was trucked. The percentage distribution of total trucked grain by type of business operation was: Country elevators, 33.0; terminal elevators, 24.1. flour mills, 26.7; and feed mills, 16.2.

The transportation of grain from the farm or country elevator into terminal position by truck was undertaken by three types of operators: The merchant or itinerant trucker, the for-hire or specialized commodity carrier, and the company operating its own trucks. Most of the grain that moved direct from the farm to terminal elevators and mills by truck was transported by merchant grain truckers. Country and terminal elevators were the greatest users of for-hire carriers, whereas the flour and feed mills were the largest users of company-operated equipment.

The motor equipment used to truck grain was found to be fairly well standardized. The bobtail grain truck was generally used to transport grain from the farm to country elevators. The tractor-trailer was universally used for the movement of grain to other than country elevators by the several types of grain truckers.

Evaluation of truck operating costs indicated that typical specialized commodity carrier costs were about 17.5 to 18.0 cents per vehicle mile. Usable cost data were not available from merchant truckers and company truck fleet operators.

When trucks used by specialized for-hire carriers were operated at a 50-percent load factor, the break-even point (where revenue per hundredweight equals cost per hundredweight) appeared to be approximately 200 miles with a 30,000-pound pay load and about 325 miles for a 36,000-pound load. At a 100-percent load factor the break-even point was extended to about 1,200 miles for a 30,000-pound pay load and for a much greater distance for heavier pay loads.

Truck rates for grain were found to be relatively unstable, the rates tending to fluctuate with changes in the competitive situation both as to the supply of grain and the amount of trucking services available at a given time. Even so, there appeared to have evolved a general level of rates from country points into the several terminal markets in the area. Generally, truck rates were found to be substantially lower than rail rates between identical points of origin and destination, in some cases as much as 50 percent lower.

The loading and unloading of grain were found usually to be faster when trucks were used than when rail boxcars were employed. Time studies made during the survey showed the time required for loading trucks to be practically uniform, whereas considerable variation was found in the time required to load rail boxcars. The average time required to prepare and load a boxcar was 90 minutes. Truck-loading time was 12 man-minutes, or 36 man-minutes for loading the equivalent of a carload of grain into trucks.

Analysis of grain unloading operations showed that the automatic boxcar dump and the truck dump required the same relative labor. The truck unloading operation averaged 10 man-minutes per truckload of grain or 30 man-minutes per carload equivalent of grain. Boxcars were unloaded by the car dump in 7 minutes, but 28 man-minutes were consumed since four-man work crews were employed. Power shovels were the most common form of unloading equipment used for unloading grain from boxcars, but they were also the least efficient from the standpoints of time required and labor cost. The average time required to unload was 32 minutes with a working crew of four men to a boxcar.

A comparison of total operating costs for the three types of grain unloading equipment indicated that the power shovel is less expensive to operate than either the truck dump or the car dump at low levels of utilization. The unloading potential of the truck dump, in terms of volume of grain handled per unit of equipment employed, was found to be about equal to that of the power shovel but substantially less than the unloading capacity of the car dump.

Shippers' reasons for diversion of business from the railroads to motortrucks in order of importance were: (a) Lower rate, (b) better service, (c) boxcar shortage, (d) lower handling costs, and (e) to increase the volume of grain shipped.

Principal shipper objections to the trucking of grain were: (a) Unethical business practices, (b) disruption of existing marketing channels, and (c) lack of transit privilege.

THE TRANSPORTATION AND HANDLING OF GRAIN BY MOTORTRUCK IN THE SOUTHWEST

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INTRODUCTION

Until quite recently the motortruck was used primarily for the initial movement of grain from the farm to the country elevator, where it was assembled for shipment to terminal markets in rail carload lots. From these country assembly points the transportation of grain, particularly wheat and coarse grains, was virtually 100 percent by rail carrier.

For many years grain has been marketed through a central market system. Under this system the major part of the grain assembled at country elevators scattered at many hundreds of points throughout the grain-producing areas was funneled into a very small number of central or terminal markets for inspection and grading, sale, storage, and processing by mills at those points. The grain, other than what was processed at these terminals, ultimately moved by railroad to other markets or mills or to ocean ports for export.

Terminal elevators and mills were built at strategic rail terminal points, and the country elevators were located along the railroad right-of-way in the grain-producing areas. The assembly, storage, processing, and transportation functions of the grain industry under the central marketing system were built solidly around the railroads.

To insure that an adequate supply of grain moved into each of the various terminal markets, transportation rates were established to provide definite relations between the terminal markets and to maintain for each central market wide areas for the purchase of grain. Thus, the grain traffic was in effect tied to the rails.

During the depression years of the 1930's, the rapid decline in agricultural prices, coupled with the slower downward adjustment of railroad rates, resulted in the diversion of some grain traffic moving beyond country assembly points from the rail carriers to motortrucks. The extent of the diversion is unknown. Grain trucking continued on a small scale up to World War II, when it practically disappeared because of the restrictions placed on motor-vehicle use by gasoline rationing and the decline in the number of motortrucks available for transporting grain. Since World War II, however, the trucking of grain appears to have revived and has grown rapidly.

The expanded use of motor vehicles for the transportation of grain raises many technical and economic questions that must be answered by the industry. At present the grain industry appears to be undecided

as to the utlimate potentiality or capacity of motor transport to serve its needs. Some members of the trade regard the trucking of grain, insofar as it is taking place, as a temporary phenomenon that will decline substantially, if not disappear altogether, when the present shortage and imbalance of rail transport equipment are overcome. Others believe that the motortruck is destined to replace ultimately the railroads as the prime movers of grain and mill products. A large segment of the industry appears not yet to have given serious consideration to the possibilities of moving grain over the highways. Finally, there are those who are noncommittal and who have adopted a wait-and-see attitude.

If the trend toward increased use of trucks continues, new facilities for the loading and unloading of grain will be provided at an accelerated rate, and more truck capacity will be brought into use; old cost and rate relationships will undergo change, as will the trade relations between the farmer who produces the grain, the elevator man who handles and stores the grain, and the miller who processes it. The implications are many. It is hoped that the results of this study will place this new development in a good perspective, and that the information will be of value to all segments of the grain industry from the farmer to the ultimate consumer of the grain as well as the transportation agencies engaged in hauling it.

Purpose of Study

This study was designed to develop information that would shed some light on the extent to which the movement of grain to market by motortruck has grown in the Southwest in recent years and to determine the reasons for the diversion of this traffic from the railroads to the motor carrier. The major points considered in the report are:

1. The volume of grain (wheat and sorghum) produced in the area that is trucked to market.

2. The nature of trucking operations and an appraisal of truck equipment used.

3. The reasons for the diversion of grain traffic from the railroads to trucks.

4. The service advantages and disadvantages to the trade when grain is moved to market by truck.

5. The cost advantages or disadvantages to the farmer, the intermediate storage and handling agencies, and the mills when grain to be marketed is moved by truck.

6. The evaluation of grain-handling equipment for loading and unloading grain for trucks and rail boxcars.

7. The objections by the trade to the trucking of grain.

In carrying out the field investigation for this study, information was obtained from farmers, elevator operators, flour and feed mills, grain brokers, truckers, representatives of the railroads, and State regulatory agencies in Oklahoma, New Mexico, and Texas.

Method and Scope of Study

Preliminary study of the trucking of grain indicated that it has had its greatest development in the Southwestern States. This survey therefore, was confined to the States of Oklahoma, New Mexico, and Texas. In this area both short- and long-haul trucking of grain appeared to be more highly developed than in other sections of the country. Moreover, since grain production is widely diversified as to types, it was considered impractical from the standpoint of time and cost to cover a larger geographical area by personal interview.

In Oklahoma, emphasis was placed on the transportation facilities used for the movement of the wheat crop. In New Mexico and Texas, equal importance was given to the transportation of sorghum and wheat. The shaded areas in figure 1 indicate the counties in which field reports were obtained.

Not only are wheat and sorghum the most important grain crops in the area studied, but there was the additional advantage of being able to study the movement of a food grain and a feed grain.

The material used in the preparation of this report was obtained from many sources. The basic data relating to the volume of grain handled, elevator capacity, volume of grain trucked, and shipper reasons for trucking or not trucking grain were obtained by personal interview from country elevators, terminal elevators, and flour and feed mills. Information regarding trucking operations was also obtained from those sources as well as from truck operators. Truckers were interviewed during the period of loading and unloading, and when possible, interviews were had with small fleet operators, private carriers, and trucking brokers. Much valuable information with respect to truck capital costs, operating costs, and methods of financing truck purchases was furnished by trailer manufacturers.

Data for evaluation of loading and unloading costs were obtained by time studies in the field and from cost schedules supplied by truck and rail boxcar unloading equipment manufacturers.

The basic sample was selected at random from a total of 46 counties--15 in Oklahoma, 2 in New Mexico, and 29 in Texas. These counties produced in the 1950 crop season approximately one-half of the wheat and grain sorghums grown in those three States.

Questionnaires were completed for 117 individual grain elevators and milling operations. These concerns represented approximately 10 percent of the total such business operations in the three States.

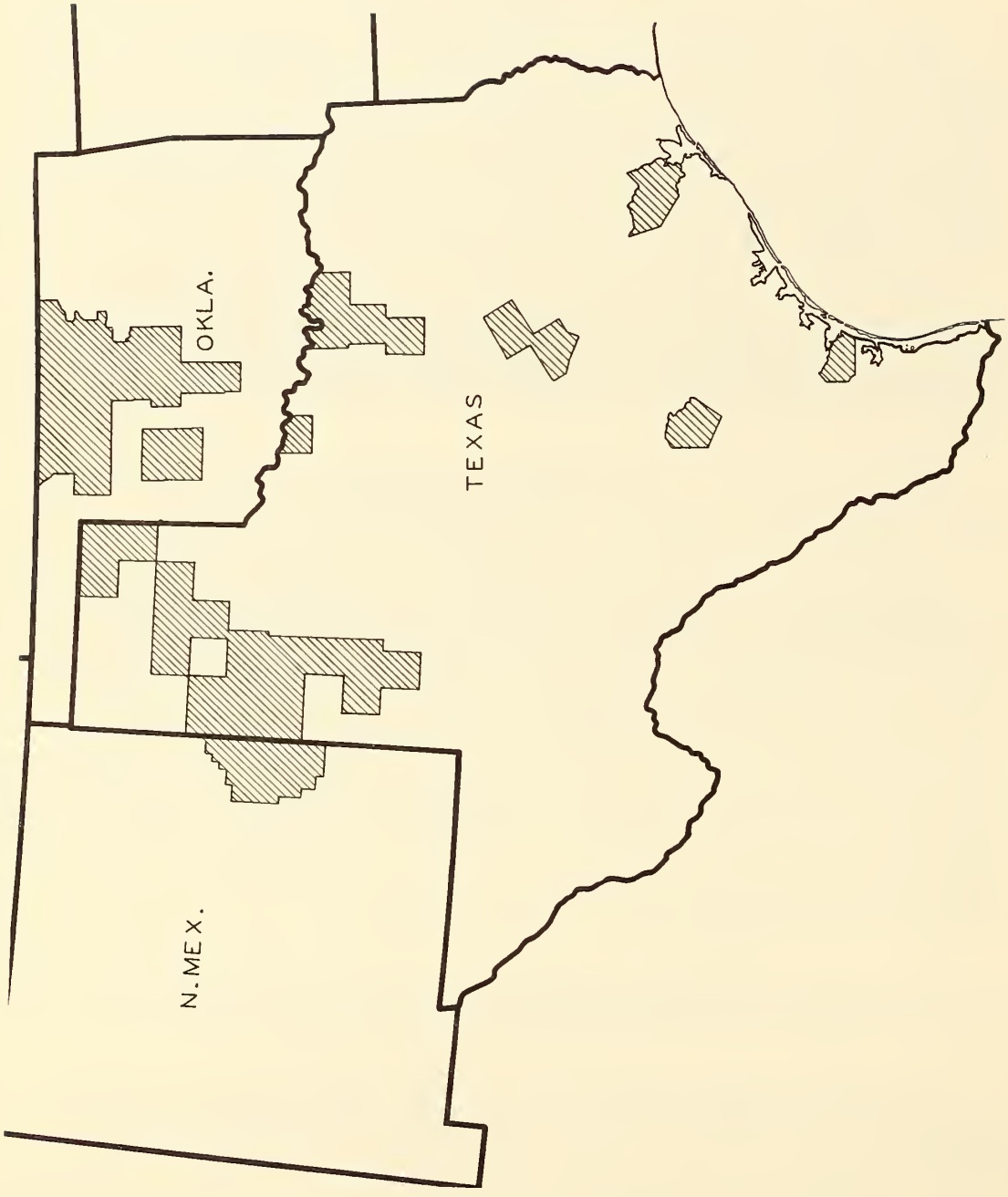


Figure 1.--Shaded areas indicate counties in which interviews were held.

On a functional basis, the 117 concerns were distributed as follows: Country elevators 77, or 66 percent; subterminal and terminal elevators 13, or 11 percent; flour mills 15, or 13 percent; and feed mills 12, or 10 percent.

Total reported grain storage capacity at these elevators and mills was 104,755,000 bushels, equal to approximately 51 percent of the estimated total grain storage capacity of 205,182,500 bushels for the 46 counties, and 32 percent of the estimated 323,049,000 bushel storage capacity for the three States.

The questionnaire and schedules used by the interviewers were tested in the field before they were used for the survey. They were edited twice, once in the field following the interview and a second time at the home office. Data of questionable validity have been thoroughly checked, and the information that was found to be incomplete or of questionable accuracy was omitted from the analysis that follows. The field work for the report was done from June 18, 1951, to July 21, 1951, and from September 24, 1951, to October 5, 1951.

Distribution of Replies on Truck Use According to Type of Business Operation

The respondents were asked whether or not they shipped or received grain by truck. The distribution of their replies, classified functionally according to type of business operation, is shown in table 1.

Data collected from 117 business concerns indicated that 90 of the respondents used motortrucks along with railroad facilities for shipping and/or receiving grain. None of the respondents used trucks exclusively in their business operation, but 27 concerns stated that all their transport facilities were provided by the railroads.

Better than 23 percent of the respondents used trucks both to ship and to receive grain. Less than 1 percent of the concerns received but did not ship grain by truck; while 53 percent of them used trucks only to ship grain. Twenty-three percent of the respondents transported grain by rail only.

When only the 90 users of trucks are considered, the distribution of replies shows that 30 percent shipped and received the grain by truck, about 69 percent used trucks only to ship grain, and 1 percent used trucks only to receive grain. The reason for omitting the truck receipts at country elevators was explained in table 1. Had these receipts been included in the tabulation, the number and percentage of concerns that shipped and received grain by truck would be substantially larger and those firms that shipped only by truck would be less.

Percentagewise flour mills were the greatest users of motortrucks. Of the 15 mills, 13 received grain by truck and used trucks to move grain from storage points to the mill or, in the case of multiple plant

Table 1.--Business operators interviewed, with replies on truck use distributed according to functional classification

Functional classification	Operators interviewed		Using trucks		Using trucks to--						Using rail only	
					Ship and receive		Ship only		Receive only			
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Country elevator	77	100.0	55	71.4	1/		55	71.4	1/		22	28.6
Terminal elevator	13	100.0	9	69.2	6	46.1	2	15.4	1	7.7	4	30.8
Flour mill	15	100.0	15	100.0	13	86.7	2	13.3	-		-	-
Feed mill	12	100.0	11	91.7	8	66.7	3	25.0	-		1	8.3
Total or average	117	100.0	90	76.9	27	23.1	62	53.0	1	0.8	27	23.1

1/ Truck receipts of grain at country elevators omitted since this survey is not concerned with the truck movement of grain from the farm to the primary market.

operations, from mill to mill, and to deliver mill products to their sales outlets. Two mills operated their own truck fleets for the local distribution of mill products, but all grain received at their elevators arrived by rail boxcar.

An analogous situation was found with regard to feed mills. Only 1 of the 12 feed mills surveyed used rail facilities exclusively. Three mills indicated that they received grain by rail but used trucks for most of their product distribution. The remaining 8 mills both shipped and received grain and commercial feed ingredients by motor transport in substantially the same manner as did the flour mills.

It was found that fewer country and terminal elevators used motor-trucks than did flour and feed mills. Of the 77 country elevator operators interviewed, 55 used trucks to ship grain to terminal positions, whereas 22 continued to use rail facilities entirely.

Four of the 13 subterminal and terminal elevator respondents used railroad equipment for all inbound and outbound shipments of grain. Although grain might have been loaded into trucks at those elevators, truck unloading equipment had not been installed to handle inbound truck shipments. At 6 elevators both truck loading spouts and unloading dumps had been installed. Grain was received direct from the farm as well as from country elevators. Two elevators used trucks only for out-bound shipments, but the management was considering the installation of truck unloading facilities; one elevator received but did not ship grain by motor transport.

VOLUME OF GRAIN TRUCKED

Of the 90 business concerns that used motortrucks for transporting grain, 77 reported both the volume of grain and the number of bushels of trucked grain they handled in 1950. These data are summarized in table 2 for each type of business operation. Approximately two-thirds of the grain shipped or received by truck was wheat and one-third sorghum. It should be borne in mind that the percentages shown in the table reflect only the volume of grain trucked by the 77 separate firms and should not be considered as an estimate of the over-all percentage of grain trucked in the three States covered by the survey.

Table 2.--Volume and percentage of grain shipped or received by truck by 77 elevators using truck transportation in 1950 1/

Functional classification	Elevators	Storage capacity	Grain handled in 1950	Grain trucked	
	Number	Bushels	Bushels	Bushels	Percent
Country elevator 2/	49	17,509,000	30,847,000	10,889,675	35.3
Terminal elevator 3/	7	15,155,000	24,455,000	7,959,000	32.5
Flour mill 3/	13	19,617,000	35,244,250	8,799,650	25.0
Feed mill 3/	8	6,970,000	15,470,100	5,364,650	34.7
Total	77	59,251,000	106,016,350	4/	

1/ Summarized from tables 10 to 13 in the Appendix.
2/ Shipments only.
3/ Receipts only. Includes subterminal.
4/ Grain trucked is not totaled because it is probable some indeterminate amount of grain shown as trucked from country elevators is also included in the amounts received by truck at terminal elevators and mills.

More than 35 percent of the grain movement from these country elevators was by truck. As nearly as can be estimated from the data provided by the individual respondents, aggregate shipments were about evenly divided between wheat and sorghum. Naturally, the volume of each kind of grain shipped by a single elevator will vary according to the relative importance of each crop in its area and according to whether the crop year was a good one or a poor one.

The seven subterminal and terminal elevators received 32.5 percent of their grain by truck. Fully three-fourths of the grain so received was wheat. Truck receipts at these elevators included shipments bought from local farmers, merchant truckers, and country elevators.

Six of the seven terminal elevators that reported the volume of grain received by truck also shipped by that mode of transport. No estimates of the volume of grain shipped by these concerns, however, are included in this report, owing to the difficulty of obtaining complete information on outbound truck movements. The interviewers were led to believe, though, that truck receipts of grain at terminal elevators were substantially greater than were shipments by those concerns.

All of the 13 flour mills that reported the volume of trucked grain receipts also shipped grain or mill products by truck. For reasons similar to those given for terminal elevators, table 2 shows only the reported volume of trucked grain received at flour mills. The 25 percent of grain received by truck includes that bought from merchant truckers, local farmers, terminal elevators, and grain hauled in company-owned trucks.

The eight feed mills received 34.7 percent of their grain by truck. Grain receipts were nearly all sorghum. Truck receipts of bone meal, bran, and other feed ingredients are not included in the reported truck receipts. A considerable proportion of the production of sorghum is converted into feed and distributed locally from the feed mill to the consumer either as bulk feed or sacked mixed feed. It was not possible to separate local deliveries from long-distance ones. For this reason shipments from feed mills are omitted from this study.

The volume of grain handled by motortruck varied substantially among the business concerns that used that method of transportation. The percentage distribution of the elevators and mills covered by the survey according to the volume of grain handled by truck in 1950 is shown in tables 10 to 13 in the Appendix. Although the 49 country elevator operators using trucks reported that 35.3 percent of the grain they handled was shipped by truck, it is well to note that more than one-third of them trucked only 10 percent or less of total grain handled. On the other hand one-fifth of the country elevators shipped more than 70 percent of grain by truck. An analogous situation was found among the 7 subterminal and terminal elevators, 4 of which received less than 30 percent of their grain by truck, whereas 3 received more than 50 percent.

Only 2 of the 13 flour mills stated that all grain receipts at their mills arrived by truck, and only 1 other mill indicated receipts by truck of more than 50 percent.

Feed mill receipts of trucked grain were widely dispersed percentagewise, one-half of these concerns receiving more than 30 percent of their grain by truck.

The data shown in the Appendix were tested to determine if there was any relationship between the storage capacity, the total volume of grain handled, and the amount of grain shipped or received by truck,

The scatter diagrams showed little or no correlation between these variables. Management decisions with respect to the trucking of grain appear to be dictated by considerations other than the size of the business.

TYPES OF GRAIN TRUCKING OPERATORS

Grain is trucked to market under a variety of hauling arrangements. Of course, grain is usually moved from the farm to the country elevator by the farmer in his own truck. In some instances, the grain is transported from the field by the combine crews who not only furnish the equipment for harvesting the grain but often operate one or more trucks and provide both the harvesting and transportation service for the farmer. The grain may be moved to the farmer's storage bins or to the country elevator. The truck equipment used for this movement of the grain is usually small and ranges in size from a ½-ton pick-up to a 250-bushel bobtail grain truck.

Of course the farmer is interested in disposing of his product where he can obtain the best market price at the time he wants to sell. Trucking of grain by farmers into terminal and mill points appears to take place largely at and following the peak of the harvest when car supply is short and country elevators cannot handle additional volumes of business. The farmer may or may not return with a partial or full load of feed, fertilizer, binder twine, fence posts, or other items for farm consumption.

The commercial transportation of grain from the farm or country elevator into terminal position by truck is undertaken largely by three distinct types of truck operators: The merchant or itinerant trucker, the for-hire or specialized commodity carrier, and the company operating its own trucks. These carriers usually use tractor-trailer combinations capable of carrying pay loads of 30 to 40 thousand pounds.

Merchant Trucker

The preponderance of grain that moves direct from the farm to terminal elevators and mills is transported by merchant grain truckers. During the harvest season, this truck owner-operator moves into a harvest area and buys a truckload of grain from the farmer as it is being combined, or the truck may be loaded with grain from the farmer's storage bins. The business transaction is for cash, and title to the grain passes immediately to the merchant trucker. As an inducement to sell his grain, the merchant trucker may offer the farmer several cents more per bushel than the farmer can obtain for the same grain at the local elevator. In addition, the farmer is saved the time and expense of loading and transporting the grain to the country elevator. The merchant trucker then carries the grain to the market that will offer him the best price on arrival or at which he can obtain another load of other commodities.

Some evidence was found to indicate that merchant truckers occasionally return to the same farmer or local elevator for additional loads of grain during the harvest season. For example, an instance was cited to the interviewers of a merchant trucker contracting to buy the entire crop of a farmer, some 30 to 40 thousand bushels of wheat, the

farmer agreeing to store the wheat in his bins and the trucker agreeing to draw on it at regular intervals. The precise financial terms of the agreement were not learned.

That kind of business transaction is exceptional. Typically, the merchant trucker follows the traffic, and usually the time lapse between the receipt of his first load of grain and his return would cause him to move into a new harvest area. Moreover, in the event the trucker was able to pick up a new load of goods at the place where he sold the grain, it would be unlikely that it could be disposed of in the vicinity where he originally bought his grain.

Although the peak operations of the merchant trucker are during the harvest season, this type of grain movement is far from being strictly seasonal. During both the harvest season and the off-season, the merchant trucker buys grain from country and subterminal elevators. As with the farmer, he pays the elevator operator spot cash for the grain and often pays a premium of 5 to 10 cents per hundredweight above the track price. Besides the direct financial incentive to sell to the merchant trucker, the elevator operator avoids the loading expense he would incur if the grain were shipped by rail, as well as the risk of loss and damage.

Specialized for-Hire Carrier

The specialized for-hire carriers are specialized commodity carriers that operate one or more trucks on a for-hire basis. Not many of them are very large organizations, though, and the number of tractor-trailer units operated by a single carrier generally will not exceed a half dozen. Moreover, few carriers were found that hauled grain exclusively. The majority of them found it necessary to transport other commodities in season in order to keep their drivers and equipment regularly employed.

Commodities such as livestock, wool, mohair, livestock feedstuffs, farm machinery, timber in its natural state, fertilizer, and grain comprise the bulk of products hauled by these carriers. These are agricultural commodities and farm supplies, the transportation of which is exempt from economic regulation under the motor carrier regulations of the State governments so long as the carrier does not transport any other property for compensation. (When the operations of the carrier are interstate, he operates either as an exempt agricultural carrier or a contract carrier under the regulations of the Federal Motor Carrier Act.) These for-hire carriers operate under operating permits granted by the State. The permits specify the kinds of commodities that the carriers may haul and the radius of territory over which they may operate. Instances were reported of this type of operator turning merchant trucker. By so doing he is not required to submit annual operating reports to the State regulatory agency. The carrier merely files a blank

form for the sake of compliance so as to protect his operating rights as a specialized motor carrier.

The bona fide specialized commodity carrier does not take title to the grain he hauls. In grain trucking, it is customary for the operator to enter into a contractual agreement with the farmer or country elevator or with some agency at the terminal market to haul a specified quantity of grain for his account, delivery to be made at certain specified intervals and for a specific transportation charge.

Company-Operated Trucks

This category of carrier--the company-operated truck--consists of country and terminal elevators that operate their own truck equipment, and the mills that employ a large number of truck units for the distribution of mill products. Different incentives cause these concerns to truck their own grain.

Instances were found where country elevators had bought trucking equipment and trucked grain regularly to market. Distances ranged from 200 to 600 miles. Return loads consisted mainly of fertilizer that was delivered directly to the farmer and at a price lower than it could be bought from a feed store. One operator claimed that the merchant truckers had forced him into the trucking business as a defensive measure. He had canvassed the farmers in his trade area and asked for the opportunity to meet the trucker's price. If his bid was successful, he sent his truck out to pick up the grain. The added cost was offset by the profit from the return load of fertilizer. One case was found where the country elevator operator, instead of using his own equipment, hired a trucker to carry the grain for his account. Thus he accomplished indirectly what the other did directly but avoided the truck operating expense and investment in equipment.

It was found that the extent to which terminal elevators trucked grain in their own equipment varied according to their size and location. The greatest amount of trucking was done by terminal elevators that operated line elevators. These terminal elevators trucked grain from outlying points: (1) When their line elevators were plugged, (2) when they could not get boxcar delivery to country points when they wanted it, (3) when the distance involved meant trucking costs equaling the rail rate, and (4) when there was competition for the crop during short crop years.

Flour and feed mills frequently employed for the transportation of grain the equipment they had bought for transporting mill products. The reasons were many. The more important ones were: (1) The use of their own equipment provided an opportunity for its more complete utilization; (2) it was frequently cheaper for them to transfer grain inventories between mills by truck than it was by rail; (3) the grain remained under their control; (4) service was better, especially in view of recurrent car shortages; and (5) they conserved boxcars for mill-product shipments that otherwise would be required to ship grain.

TYPES OF GRAIN TRUCKING EQUIPMENT USED

Grain is transported from the farm to market in a variety of trucks. As noted earlier, truck size and body type will range from the ½-ton pick-up truck to trucks and tractor-trailer combinations with a pay-load capacity of 15 to 20 tons.

The bobtail grain truck shown in figures 2 and 3 is widely used in the Southwest to haul grain from the farm to country elevators and nearby terminal elevators and mills. In addition to farmer ownership, this type of truck is standard equipment for use by for-hire combine crews that follow the harvest. The truck is used to carry the combine from one producing area to another and to transport the grain to farm storage or local elevators during combining operations.

The body specifications for the bobtail grain truck are pretty generally standardized among body manufacturers. In practice, the owner of the truck purchases the cab and chassis, then has the truck body installed by a body manufacturing company. The standard grain truck body has a flat bed about 8 feet wide and 13 feet long. The bed is constructed of an all-steel frame that is floored with a 2-inch thick, full-length, tongue and groove pine that provides a grain-tight flooring. The grain boards, or side panels, are set into the stake pockets on a flat bed. The end gates are made in two sections and are held in a tight position by a heavy-duty chain and boomer. Tie rails are provided on each side for tying down a tarpaulin.

The bobtail truck is simply a general utility farm truck and is not well adapted to long-haul transportation of grain because of its limited load capacity. The pay load is governed by the height of the grain boards. (See table 3.) These may vary in height from 2 feet 6 inches to 4 feet, the pay load ranging from 200 to 300 bushels of grain. The most commonly used grain board is 3 feet high, which permits a pay load up to approximately 250 bushels of grain.

Analysis of the truckload receipts at one large elevator for the period June 16 to 25, 1950, showed that of 319 truckloads of wheat received from farmers, the average weight per delivery was only 13,060 pounds, or 218 bushels. An on-the-spot check of 10 truckloads received from farmers using the grain truck on June 23, 1951, showed delivery weights ranging from 8,290 pounds to 14,820 pounds, the average load weighing in at 11,307 pounds. This latter figure is equivalent to 188 bushels of grain. In both samples the farthest distance from which grain was trucked was about 30 miles.

The compelling reason why the farmer or the combine-truck operator does not engage in the long-haul movement of grain is the harvesting itself. Deliveries can be made only for relatively short distances if the transport operation is to keep up with combining operations. For the most part, deliveries of grain are made to the

Figure 2.--Bobtail truck with standard wooden grain boards.

Figure 3.--Rear view of bobtail truck with dump body at tilt and showing grain gate.

nearest country elevator, and only when the local elevator is plugged or the farmer has to "shop" for a buyer will he transport the grain more than 25 to 30 miles.

For over-the-road, long-haul grain movement, the grain trailer is universally used. Trailers may be single axle or tandem and will vary in length from 28 to 40 feet, the exact length depending upon the size and weight limitations that prevail in the State or States in which they are operated.

Basically the body design and construction of grain trailers are similar to the grain truck body previously described. (See figs. 4 and 5.) One novel feature of grain trailer design is the metal front formed to fit the contour of the bed at the front end of the trailer. The front is removable and may be folded down. When the tail gate is also removed, some economy of gasoline and time is claimed, since wind resistance is reduced when equipment runs empty.

Like the grain truck, the cubic and weight capacity of the trailer is governed by the height of the grain boards. (See table 3.) The owner at his option may use grain boards of 30, 36, 42, or 48 inches in height. Most trailers are provided with removable spreader bars that position the grain boards firmly. The bars also support the tarpaulin. Of the trucks observed during the survey, the most common grain board height in use was 3 feet 6 inches.

Both the grain truck and grain trailer are general-purpose equipment. Cattle boards may be substituted for grain boards for hauling livestock. Moreover, with the sides removed the trailer converts into a platform float for moving bulky loads, lumber, timber, farm machinery, and other commodities.

A second advantage claimed for the grain trailer is that its light weight permits a larger pay load and permits the use of tractors of smaller horsepower rating than is required for van-type trailers. The lighter equipment makes it more maneuverable and results in less driver fatigue.

Because of the simplicity of design and the light weight, the cost of the grain trailer is considerably less than the cost of van-type equipment. For example, a 30-foot single-axle trailer can be purchased for about $2,500 and the tandem-type for approximately $4,000. Van-type trailers of similar size would cost approximately twice as much. The fact that the equipment is of lighter weight and of simple design also tends to minimize the cost of equipment maintenance.

The grain trailer is ideally suited for the loading and unloading of grain. It may be drawn alongside the combine and the grain spouted directly into it. At elevator loading sheds, grain can be spouted into the truck without prior modification of elevator loading spouts.

Figure 4.--Tractor and 30-foot tandem axle grain trailer with metal grain boards.

Figure 5.--Rear view of single-axle grain trailer with wooden grain boards and showing tail gate.

Table 3.--Dimensions and estimated loading capacity of the bobtail grain truck and standard 30- and 34-foot grain trailers according to height of grain boards

Truck or trailer	Bed width	Bed length	Grain board height	Capacity	Loading capacity			
					Wheat		Sorghum	
	Feet	Feet	Inches	Cubic feet	Bushels	Pounds	Bushels	Pounds
Bobtail	8	13	30	260	208	12,480	208	10,400
do.	8	13	36	312	250	14,970	250	12,480
do.	8	13	42	364	291	17,470	291	14,560
do	8	13	48	416	333	19,970	333	16,640
30' trailer	7½	30	30	562½	450	27,000	450	22,500
do.	7½	30	36	645	516	30,960	516	25,800
do.	7½	30	42	787½	630	37,800	630	31,500
do	7½	30	48	900	720	43,200	720	36,000
34' trailer	7½	34	30	637½	510	30,600	510	25,500
do	7½	34	36	765	612	36,720	612	30,600
do.	7½	34	42	892½	714	42,840	714	35,700
do.	7½	34	48	1,020	816	48,960	816	40,800

The loading operation is simple, and 600 to 800 bushels of grain may be loaded in about 4 minutes. The simplicity of the actual unloading operation corresponds to that for loading. Trailers may be unloaded rapidly, usually in about 4 to 6 minutes, and manpower requirements are considerably less than for the unloading of boxcars.

OPERATING COSTS OF FOR-HIRE GRAIN TRUCKERS

In the course of this survey, interviews were had with grain truckers, transportation men in the grain trade, and others associated with truck transportation. All of these people had some general idea of truck operating costs for their particular trucking operation, but few of them kept records that permitted the segregation of individual truck operating costs. The absence of business records was particularly noted among the merchant truckers interviewed. Although the larger elevators and mills usually had adequate accounting systems, it was not practicable to segregate trucking costs from other business expenses. Moreover, had this been practicable, it would not have been feasible to allocate the costs properly chargeable to the several types of trucking operations carried on without detailed study of the concern's operations. The most useful information regarding truck operating costs was obtained from the for-hire carriers. Although individual truck operating costs were not available, data were obtained from four such carriers covering their over-all operations. In the analysis that follows the operating statistics and cost data have been averaged out on a per-vehicle basis. Thus, the various cost figures are intended to reflect only a reasonable approximation of typical vehicle operating costs for the operations of each carrier.

The significant operating statistics of four for-hire carriers in Texas that are haulers of grain and feedstuffs are summarized in table 4. Each carrier's base of operations is in a different section of the grain-producing area, and each one hauls grain locally as well as to terminals outside of the area of production. However, the scale of operations differs substantially in degree, if not in kind, and these differences are reflected in the variations in the cost experiences of each carrier.

The first section of table 4 presents, on a unit or vehicle basis, the operating statistics for each carrier necessary to compute the various tonnage and mileage costs.

Two sets of cost figures were computed for the for-hire carriers. The mileage and tonnage costs shown in the second section of the table are derived from the total operating costs for each carrier, which includes a proprietor salary expense. The cost schedule in the third section of the table analyzes net operating expenses when no allowance is made for proprietor salary. The assumption is that the proprietor is entitled only to the income that the business can earn. Carrier "D" is a case in point. His profit and loss statement shows that the owner paid himself a salary of $4,800 in 1950 and that the business showed a loss of $1,600, the operating ratio being 102.6. When salary expense is omitted, the business showed a profit on operations of $3,200, and the operating ratio improved to 94.4.

The deduction of proprietor salary expense for each carrier from his total operating costs had a much greater effect on the per-vehicle

Table 4.--Average per-vehicle operating costs per mile and per ton of four for-hire carriers in Texas, 1950 1/

Item	Carrier A	Carrier B	Carrier C	Carrier D
No. of vehicles operated	2	3	7	7
Miles operated per vehicle	34,745	40,000	62,857	50,496
Tons carried per vehicle	1,201	1,500	1,808	3,535
Trips per vehicle	75	94	113	221
Trip miles per trip	464	426	556	228
Revenue miles per trip	232	213	278	114

Per-vehicle operating costs including proprietor salary expense

	Dollars	Dollars	Dollars	Dollars
Cost per trip	82.26	90.28	117.68	41.05
Cost per hundredweight	.2671	.2821	.3677	.1283
Cost per loaded vehicle mile	.3546	.4238	.4233	.3601
Cost per vehicle mile	.1773	.2119	.2116	.1800
Cost per revenue ton-mile	.0222	.0265	.0265	.0225
Cost per trip ton-mile 2/	.0111	.0133	.0133	.0113
Operating ratio	85.3	82.1	92.7	102.6

Per-vehicle operating costs less proprietor salary expense

	Dollars	Dollars	Dollars	Dollars
Cost per trip	67.52	72.55	111.50	37.94
Cost per hundredweight	.2108	.2267	.3484	.1186
Cost per loaded vehicle mile	.2910	.3406	.4011	.3328
Cost per vehicle mile	.1455	.1703	.2005	.1664
Cost per revenue ton-mile	.0182	.0213	.0251	.0208
Cost per trip ton-mile 2/	.0091	.0107	.0125	.0104
Operating ratio	70.0	65.0	87.9	94.4

1/ The cost data presented in this table are based on a one-way haul of grain and feedstuffs. Actually 9.3 percent of the carriers' revenue was derived from the carriage of household goods, oilfield equipment, timber, farm machinery, and other unspecified goods. These commodities typically are transported by grain truckers as a return load. Since the operating costs are not segregated on a mileage or tonnage basis, it was necessary to include them in the data. The effect of this type of return-haul traffic is minimized by averaging the unit operations and cost data.

2/ Cost per vehicle mile ÷ 16 (av. load in tons) or cost per trip ÷ trip miles per trip x 16.

operating costs of the smaller carriers than on the larger ones because that expense represented only a small proportion of the total operating expenses of the larger firms. The cost items in the third section of table 4 are 18 and 20 percent lower for carriers A and B, respectively, whereas carrier C's costs are reduced by only 5.5 percent and those of carrier D by 7.5 percent.

Table 4 shows considerable variations in the vehicle operating costs of the four carriers. The higher per-vehicle operating costs of carrier C are largely the result of unusually high depreciation charges against equipment in 1950. Carrier A's exceptionally low operating costs stem from exceedingly small charges for equipment maintenance for that year.

Average truck-mile costs for these four grain carriers were 17.9 cents. This figure compares favorably with the truck-mile costs reported by other similar carriers. Analysis of the annual operating reports filed with the Texas Railroad Commission by 26 specialized commodity carriers showed individual operating costs per truck mile ranging from 11.6 to 28.6 cents. However, average truck-mile costs for the 26 carriers was 18.7 cents. Fifteen carriers, 84 percent of whose traffic was grain, showed 18.2 cents as the average truck-mile cost. One carrier operating six trucks and handling about 50 percent grain and 50 percent livestock estimated his costs at between 16 and 17 cents, whereas one single truck operator estimated his mileage cost at 17.5 cents.

Figures 6 and 7 present an approximation of the relationship between the grain truck rates 1/ that were in effect in the Southwest at the time of the field survey and the average operating costs of the four grain carriers. Carrier costs are converted into cents per 100 pounds at various pay loads for 100 percent and 50 percent of the miles operated. 2/

The 100 percent loaded operation shown in figure 6 indicates that the truck is loaded to a stated pay load for the full highway distance shown; i.e., 200 miles one way or a round trip of 200 miles. When the trucking operation is carried on at a 100 percent load factor, the break-even point (where revenue per hundredweight equals cost per hundredweight) is approximately 1,200 miles for a pay load of 30,000 pounds and a much greater distance for heavier pay loads.

1/ Rate scale constructed from the truck rates given in table 8.
2/ See table 14 in Appendix for explanation of method of computing these costs.

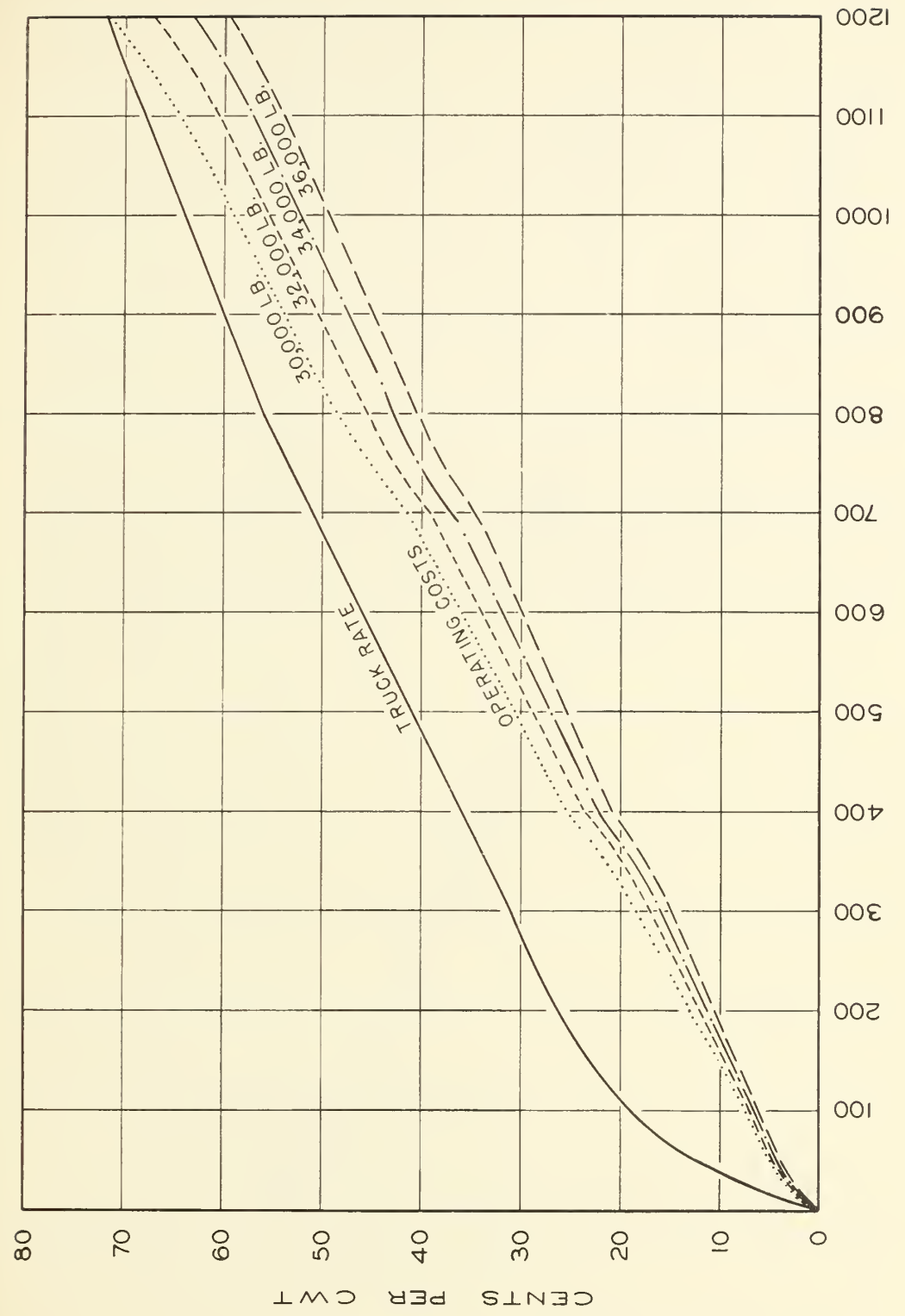


Figure 6.--Comparison of truck rates and operating costs per 100 pounds by mileage block at 100 percent pay load capacity.

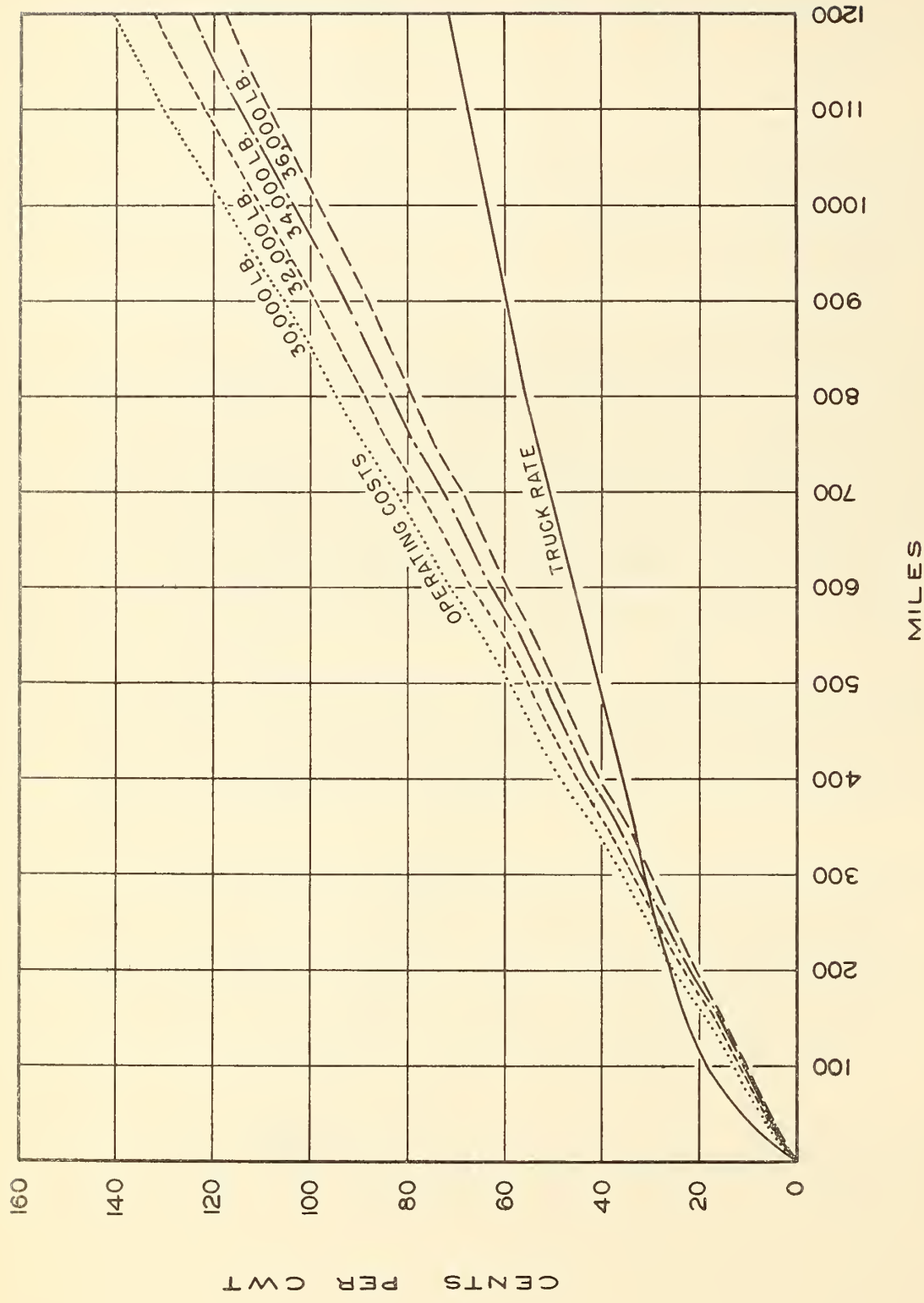


Figure 7.--Comparison of truck rates and operating costs per 100 pounds by mileage block at 50 percent pay load capacity.

The 50 percent loaded operation indicated in figure 7 shows the cost per 100 pounds for a truck loaded 50 percent of the stated pay load for a given distance, or it may be interpreted as showing the cost of a round trip loaded one way and returning empty. Obviously, when equipment is operated at 50 percent of pay-load capacity, the range of profitable operations is greatly reduced. Thus, the break-even point for a 30,000-pound pay load appears to be about 200 miles and for a 36,000-pound pay load approximately 325 miles. For distances greater than these, a higher load factor would be essential in order to carry on a profitable trucking operation.

The two graphs serve to point up the operating advantage of the merchant trucker over the for-hire trucker. The merchant trucker's operation is typically a one-way haul at a 100 percent load factor. After he sells a truckload of grain at market, he will try locally to obtain another load of some other commodity that he can dispose of profitably at another place. He follows the traffic and is under no obligation to return to the area where he bought the load of grain. On the other hand, the for-hire carrier is essentially a fixed-base operator and must return to or near the place where his business is located. Often his opportunity to obtain a return load of commodities that he is authorized to transport is limited. This makes it difficult for him to maintain a high load factor and tends to restrict the area over which the for-hire carrier may operate.

REASONS FOR USING TRUCKS TO TRANSPORT GRAIN

Historically, the movement of grain from the country elevator to the final processor or consumer has been by railroad. If, then, this traffic is being diverted from the rails to the motortruck, the shift in the transportation method chosen by shipper or consignee must result from economic considerations that affect the cost or convenience of marketing grain and grain products.

Usually the choice of a particular type of carrier is the result of the net competitive advantage of the transportation service that one carrier offers the purchaser over that of another carrier. This business or competitive advantage is generally the result of one or more economic factors. For one shipper the price he must pay for the transportation of his goods may be paramount. For other shippers regular and expeditious service is the foremost need. On the other hand, the selection of the carrier best suited to serve the transportation needs of the business may hinge upon factors bearing but indirectly on rate and service. For example, a particular method of transportation may be preferred because it makes for the more economical use of plant and facilities, or it may facilitate the scheduling of production, or it may influence inventories. Plant location in relation to source of raw materials and the market to be served is also an important management decision that is influenced by the kinds and availability of transport facilities to serve the industry's needs.

The growth of competing forms of transportation and the conventional and technological improvements in their operation have progressively made it more feasible for the purchaser of transportation to substitute one transportation service for another. In the case of grain transportation the value of the service of the railroad appears to have diminished with the development of trucking. This section of the report is concerned with evaluating the specific considerations or motives that have caused the shift in preference of some shippers from the railroad to the motortruck, as expressed by the business concerns interviewed in the field survey.

Summary of Reasons for Trucking Grain

The 117 respondents were asked to enumerate in order of importance to them their reasons for using motortrucks for the transportation of grain. Eighty-eight of the 90 concerns using trucks responded to the question. 3/ Only 2 truck users declined to give reasons for use of that mode of transport. Among the nonusers of trucks 19 gave no reason for not using trucks but did indicate that they had no objection to grain trucking. This was a neutral element. The remaining 8 nonusers of motor transport offered no reason why they didn't use trucks but did voice objections. Their objections, along with those given by truck users, will be analyzed in a later section of this report.

3/ See Appendix, table 15, for tabulation of replies.

In all but 13 instances the concern listed more than one reason for shipping grain by truck, and nearly half of the respondents gave at least three reasons.

"Better service" and "lower rate" accounted for 48 percent of the total number of reasons given. "Boxcar shortage" was mentioned 39 times and together with the service and rate factors amounted to 65 percent of total reasons. Although "better service" was given 55 times as a reason, it ranked third as first choice. "Lower rate" was given as first choice 31 times and ranked first in that choice category but was second to the service factor in the total number of times mentioned by the respondents. Although "boxcar shortage" loomed important as first choice for using trucks, it was given as a reason only 39 times.

It should be noted that the rate factor appears to be of much greater concern to country elevator operators than to the other types of operators. (See table 5.) The terminal elevator and mill operators considered "lower truck rates" second in importance to "better service." Car supply appears to be a stronger motive for country elevators to use trucks than for other types of grain operations. In short, two-thirds of the reasons for using trucks as given by the respondents bore directly on railroad services, rates, and car supply. The other one-third of the reasons given had to do with factors more or less internal to the business operation.

Lower Truck Rates

The rate factor ranked first as a reason for shipping grain by truck among the concerns interviewed. Referring again to table 5, both country elevators and flour mills regarded the price they must pay for transportation services as the dominant motive or reason in the selection of the mode of transportation. Among terminal elevators and feed mills, the rate factor was second only to service considerations as the reason for shifting from railroads to trucks.

When the country elevator operator sells his grain at the terminal market, his proceeds from the sale amount to the terminal market price minus the transportation charge and other charges. He can increase his return by obtaining a lower transportation rate. This can be done in two ways.

First, he may contract with a for-hire trucker to transport his grain to market for him. The price arrived at for transporting his grain is reached by bargaining between the trucker and the elevator operator. Although there appears to have evolved a general level of rates from country points into the various terminal markets, the trucking charge will fluctuate with changes in the competitive situation both as to the supply of grain and the amount of trucking services available at a given time.

Table 5.--Composite rating 1/ of reasons for transporting grain by motortruck according to type of business operation

Reason	Country elevator	Terminal elevator	Flour mill	Feed mill	All concerns Rating	All concerns Rank
Lower rate	130	29	43	32	234	1
Better service	104	32	40	43	219	2
Boxcar shortage	112	19	7	12	150	3
Lower handling cost	48	15	5	13	81	4
Increase volume of grain shipped	55	-	5	10	70	5
Profit from trucking operation	30	5	17	10	62	7
Less labor and manpower regardless of cost	-	4	3	4	11	8
Lack of adequate storage facilities	7	-	-	-	7	9
Other reasons	41	3	18	4	66	6

1/ Scoring in table 15, Appendix, arranged by type of business operation and weighted by assigning a rating of 5 points when reason given was first choice, 4 points if second choice, etc., and one if fifth choice. It is realized that any method used for weighting these data would be arbitrary, and the weights used here are merely a convenient method of giving some approximation of the relative importance of each reason to each type of business concern.

Table 6 gives a general idea of the for-hire truck rates prevailing in the Southwest during June and July 1951 into several terminal markets and their relation to the rail rates from country points. They were obtained from the shippers and receivers of grain and truckers interviewed in the course of the survey. Although some of the point-to-point rate comparisons may seem inconsistent, it should be kept in mind that the truck rates fluctuate with the competitive situation so that the rates given in the table represent the price prevailing at a given time.

In almost every instance truck rates are well below the rail rates between corresponding points. The difference between the two transportation charges accrues generally to the country elevator operator, although the mills to which the grain is sold may seek to discount the price of the grain by several cents. Nonetheless, the country elevator operator benefits over what he would have received had he shipped by rail.

Trade relations between the country or terminal elevators and the mills are usually long established; therefore, when the elevator operator ships grain to a mill by truck, the business transaction is not between strangers, and there is less tendency for the buyer to drive too sharp a bargain. Rather, the difference between the truck rate and the rail rate is usually shared between the two parties. Whatever the division of this saving, both the buyer and the seller of the grain benefit.

The second benefit follows from the fact that the country elevator operator may sell his grain to a merchant trucker. The majority of elevator operators interviewed stated it was their practice to charge the trucker a premium of about 5 cents per bushel, or 10 cents per hundredweight. For every carload equivalent of trucked grain that he sells at a 10-cent premium over his track price, he makes $100 profit, or about $33 per truckload. When the trucker sells his grain at the terminal market the price he receives for it is usually about 10 cents under the delivered rail price.

As a practical proposition, the merchant trucker will buy grain whenever possible directly from the farmer. The farmer will sell his grain to the merchant trucker because the trucker will pay him several cents more per bushel or per hundredweight for his grain than he can obtain from the country elevator. In addition, the farmer saves the time and expense of transporting his grain to market. By going directly to the farmer for his grain, the merchant trucker avoids having to pay for the elevator handling charge plus the premium. He is willing to share this saving with the farmer and thereby increase his gross margin.

The rate differential between rail and truck reflects itself in the grain buyer's decision to handle trucked grain. As a matter of practice, flour and feed mills purchase grain from merchant truckers at a discount up to 10 cents a hundredweight under the delivered rail price. The reason for the discount was explained on two premises. The first premise was that the buyer is required to protect his transit. The second premise, according to some buyers, was that they would have no incentive to purchase trucked grain and no logical reason for incurring the expense of installing truck unloading equipment unless the grain could be bought at something under the delivered price by rail.

The buyer can continue to have all the grain he requires delivered by railroad at the current market price. The merchant trucker, on the other hand, must sell his load as quickly as possible if the haul is to be profitable; otherwise his road expense will soon eat up his profit. Occasionally there are times when competition among buyers for the crop in a particular area may cause them to pay a premium price for trucked grain. The premium price, though, is over the going truck discount price and will seldom exceed the competitive rail price.

Table 6.--Comparative rail and truck rates for wheat and coarse grain in cents per 100 pounds

Origin	Destination	Distance in miles		Rail carload rates per cwt. 1/		Truck rates per cwt.	Savings by truck over rail	
		Rail	Highway	Wheat	Coarse grain		Wheat	Coarse grain
		Miles	Miles	Cents	Cents	Cents	Cents	Cents
Farwell, Tex.	Amarillo, Tex.	91	95	25½	15	25	½	-10
Happy, Tex.	do.	35	30	18½	10½	15	3½	- 4½
Plainview, Tex.	do.	75	74	24	13½	20	4	- 6½
Sudan, Tex.	do.	132	129	29½	20½	30	- ½	- 9½
Dimmit, Tex.	Clovis, N. Mex.	186	55	38	38	15	23	23
Farwell, Tex.	do.	9	10	15½	15½	5	10½	10½
Lariat, Tex.	do.	19	19	20½	18½	5	15½	13½
Muleshoe, Tex.	do.	31	32	20½	18½	10	10½	8½
Alva, Okla.	Enid, Okla.	60	70	22½	22½	11	11½	11½
Bison, Okla.	do.	13	15	15	15	6	11	11
Blackwell, Okla.	do.	48	62	19½	19½	10	9½	9½
Cherokee, Okla.	do.	42	51	19½	19½	9	10½	10½
Fairview, Okla.	do.	57	47	20½	20½	10	10½	10½
Hennessey, Okla.	do.	20	20	15	15	7	12	12
Okarche, Okla.	do.	46	48	19½	19½	11	8½	8½
Perryton, Tex.	do.	192	203	38	38	26	12	12
Waukomis, Okla.	do.	8	9	13½	13½	6	7½	7½
Woodward, Okla.	do.	102	113	26½	26½	16	10½	10½
Brownfield, Tex.	El Paso, Tex.	498	310	64½	58½	25	39½	33½
Clovis, N. Mex.	do.	358	357	65½	65½	30	35½	35½
Littlefield, Tex.	do.	493	363	64½	58½	30	34½	28½
Lubbock, Tex.	do.	457	348	62½	58	50	12½	8
Portales, N. Mex.	do.	376	338	67½	67½	25	42½	42½
Sudan, Tex.	do.	508	381	64½	58½	40	24½	18½
Tulia, Tex.	do.	528	418	64½	58½	40	24½	18½
Amarillo, Tex.	Fort Worth, Tex.	335	338	43	40	30	13	10
Brownfield, Tex.	do.	363	306	43	40	30	13	10
Corpus Christi, Tex.	do.	400	389	49	46	30	19	16
Dalhart, Tex.	do.	418	425	46	50½	35	13	15½
Dimmit, Tex.	do.	366	369	43	46	35	8	11
Lubbock, Tex.	do.	322	294	43	39	35	8	4

See footnote at end of table

Continued --

Table 6.--Comparative rail and truck rates for wheat and coarse grains in cents per 100 pounds-Continued

Origin	Destination	Distance in miles		Rail carload rates per cwt. 1/		Truck rates per cwt.	Savings by truck over rail	
		Rail	Highway	Wheat	Coarse grain		Wheat	Coarse grain
		Miles	Miles	Cents	Cents	Cents	Cents	Cents
Muleshoe, Tex.	Fort Worth, Tex.	390	364	43	46	35	8	11
Pampa, Tex.	do.	325	326	43	40	30	13	10
Perryton, Tex.	do.	476	375	47	46	35	12	11
Plainview, Tex.	do.	323	325	43	40	30	13	10
Tulia, Tex.	do.	348	349	43	40	30	13	10
Vernon, Tex.	do.	163	165	35½	25½	15	20½	10½
Brownfield, Tex.	Houston, Tex.	565	562	52½	46	40	12½	6
Corpus Christi, Tex.	do.	221	218	41½	34½	25	16½	9½
Farwell, Tex.	do.	614	643	54	47	50	4	- 3
Fort Worth, Tex.	do.	260	275	41½	34½	13	28½	21½
Littlefield, Tex.	do.	561	587	52½	46	45	7½	1
Lubbock, Tex.	do.	524	551	52½	46	45	7½	1
Tahoka, Tex.	do.	529	535	52½	46	40	12½	6
Amarillo, Tex.	Los Angeles, Cal.	1,198	1,086	101	86½	70	31	16½
Clovis, N. Mex.	do.	1,095	1,019	101	86½	60	41	26½
Farwell, Tex.	do.	1,104	1,028	101	86½	60	41	26½
Lubbock, Tex.	do.	1,193	1,120	101	86½	70	31	16½
Muleshoe, Tex.	do.	1,082	1,050	101	86½	60	41	26½
Portales, N. Mex.	do.	1,113	1,038	101	86½	60	41	26½
Anton, Tex.	Lubbock, Tex.	24	26	16	10½	10	6	½
Brownfield, Tex.	do,	41	38	19½	10½	15	4½	- 4½
Dimmit, Tex.	do.	90	82	25½	15	20	5½	- 5
Kress, Tex.	do.	59	58	20½	12	15	5½	- 3
Lariat, Tex.	do.	80	83	24	13½	20	4	- 6½
Plainview, Tex.	do.	47	46	19½	10½	15	4½	- 4½
Slaton, Tex.	do.	15	17	15	9	10	5	- 1
Sudan, Tex.	do,	52	54	20½	12	15	5½	- 3
Tulia, Tex.	do.	71	70	24	13½	20	4	- 6½
Dimmit, Tex.	Portales, N. Mex.	204	74	41½	41½	15	26½	26½
Farwell, Tex.	do.	27	29	19½	18½	10	9½	8½
Lariat, Tex.	do.	37	38	24	18½	10	14	8½
Muleshoe, Tex.	do.	49	51	24	18½	15	9	3½

1/ Rates in effect at time of survey and prior to the 6 percent rate increase granted by Ex Parte 175 effective September 12, 1951.

Some mills found it expedient to transport grain from their line elevators or interior terminal points to their mills in their own truck equipment. They even bought grain directly from the farmer and transported it into storage position. If truck-operating costs per hundredweight are substantially lower than the rail rate, then the buyer, if necessary, can pay the farmer a premium price for his grain and still realize a saving over the cost if the grain is shipped by rail.

Better and More Expeditious Service

The service factor in transportation has two aspects, one being the quality of service offered by the carrier, the other being the quantity of transportation available to the shipper. This section is limited to the discussion of quality of service as a factor in the grain shipper's selection of the carrier that best serves his business needs. The importance of supply of transportation to the shipper of grain is considered in the next section on boxcar shortage.

The ability of the country elevator operator to conduct his business profitably is largely dependent upon the quality (and quantity) of the transportation services available to him. Fast turn-over of his merchandise is essential to business success. This is particularly true during the harvest season; otherwise, he will be forced to turn daily deliveries over to a competitor, and his daily receipts will be impaired.

Among the country elevators interviewed, delay in the placement of empty boxcars and the hauling away of loaded ones appeared to be the dominant shortcoming in rail service that caused those operators to divert their shipments of grain from rail to the motortruck. Instances were cited when boxcars were ordered and promised for spotting at elevators on a certain day, and it would be one or more days later when the cars were delivered.

Delay in car placement was particularly objectionable when the shipper's order was placed toward the end of the week. For example, a car might be ordered on Thursday, and it would be the following Tuesday or Wednesday before the car would be spotted by the railroad for loading at the elevator. The consensus of country elevator operators was that these delays bore little, if any, relationship to boxcar supply. Indications were that spotting and pull-away service deficiencies were chronic.

Many country elevators, because of their rural location or position on the rail line, do not have daily rail service. Nonetheless, these shippers want to load cars and ship at their convenience--not at the pleasure of the carrier. The view was frequently expressed that rail service on additional days should be provided when the volume of grain to be moved justified it.

Many country elevator operators who do ship grain by truck say they do so because the trucker offers them a prompt shipping service. When the shipper arranges with a trucker to haul his grain, it is loaded on

the day and at the time designated by the shipper. It takes only a few minutes to load the truck and get it on its way so that a second truck may be loaded. Such shippers state that this operation is much faster and easier to perform than loading a boxcar, even under the best conditions.

At terminal points, elevators and mills expressed more concern over terminal switching time than for delay in the placement of boxcars for loading. Most terminal elevators and large mills are able to spot cars for loading by using a car puller, a mechanically operated cable that is attached to the boxcar and the car then moved into loading position.

Very often, though, an elevator or mill is located on a railroad other than the carrier that transported the grain. Under those circumstances the boxcars carrying grain consigned for that elevator must be turned over to the railroad on which the elevator is located. This involves interline switching. For short-haul movements of grain, switching time may equal or even exceed line-haul time. Instances were cited at some terminal points where cross-town switching, a distance of 2 or 3 miles, took 2 days longer. On the other hand, trucks haul grain direct from the shipper to the consignee's elevator without terminal delay either en route or at destination.

All groups of respondents objected to the physical condition of the boxcars provided by the railroads. Railroad rules regulating the safe loading of bulk grain in closed cars and protection of equipment, as issued by the Association of American Railroads, require that cars must be clean, with inside lining and doorposts in good repair in order to be suitable for the transportation of bulk grains. In short, the carrier is supposed to furnish the grain shipper class A cars for the loading of grain and grain products. Instances were cited to, and observed by, the interviewers in which cars furnished for grain loading were in substandard condition. When the shipper is obliged to clean dirty cars or make repairs before the car is suitable for loading, the loading is delayed and added labor and other costs are incurred. One large operator estimated that it cost his company from $6 to $8 to prepare a boxcar for loading Dirty cars are largely the result of shipper negligence in removing dunnage and debris from cars before they are returned to the carrier. Still, the railroads must assume responsibility for the physical condition of their equipment.

Each trucker of grain assumes full responsibiliby for the cleanliness and condition of his truck or trailer. He levels his own load and ties down the tarpaulin over the load. Thus, the shipper saves both the time and expense that would be incurred in preparing a boxcar for grain loading. This is especially important at country elevators, the majority of which are a one- or two-man operation.

The time required to ship grain from point of origin to destination is another significant factor in the diversion of grain traffic from rail to motortrucks. This service consideration includes both line-haul time and switching time as discussed above.

To the extent that in-transit time can be reduced, the owner of the grain can minimize the risk of loss or damage. The risk factor is of special importance to the owner when grain of high moisture content is shipped--and much new harvest grain is in that condition. If the over-all transit time is of relatively long duration, the moist grain sealed in the boxcar will soon go out of condition owing to lack of air circulation and heat generation. In consequence, it will be down graded on inspection, and the financial loss to the owner may be considerable. In the extreme case, the shipment, if a food grain, may be condemned as unfit for human consumption.

Another hazard confronting the owner of grain is shrinkage. Grain of a given moisture content will weigh so much per bushel at the time of loading. The longer the transit time in moving the grain to market, the greater the opportunity for the grain to lose weight by loss of moisture content. Some respondents said that it was not uncommon for a carload of grain to undergo a loss of from 800 to 1,000 pounds because of shrinkage while in transit. Under the tolerance rule, which limits the rail carrier's liability for grain loss due to shrinkage, the owner of the grain is seldom able to receive full compensation for this type of loss. For example, Western Trunk Line Freight Tariff No. 330-N provides that the carrier shall not be responsible for losses due to shrinkage, and when the carrier's liability for loss is established, that there shall be deducted from the loss on all grain 1/8 of 1 percent of the total weight of the contents of the car. According to shippers of grain by truck, loss or damage to grain is practically eliminated. With the grain moved to market in a matter of hours, there is little opportunity for change in the condition of the commodity.

From the service viewpoint, perhaps no single factor in itself would cause any significant diversion of traffic from the rails to motortrucks. Rather, it was the combination of the several service factors discussed above. Terminal elevators generally advanced reasons similar to the country elevators for using trucks. Line haul and switching time were the principal objections to rail service. Terminal elevators appeared to be less concerned about car condition than were country elevators. This is probably because terminal elevators are better equipped and most of them employ loading and unloading crews solely for the purpose of grain handling. Such specialization or division of labor is seldom found in country elevator operations.

Delay in car placement may not justify diversion, but when 2 or 3 days' delay in line switching is added to transit time, then the amount of delay does become significant. It was found that grain sorghum produced west of Corpus Christi, Tex., moved by truck 200 to

250 miles to Houston in 5 to 6 hours. Truck turn-around time from the producing area to Houston and return was 1 day. Rail turn-around time was reported to range from 5 to 7 days. Similarly, grain was transported by truck from interior points around Lubbock and Amarillo, Tex., to Gulf ports, a distance of 600 miles, within 24 hours. Scheduled rail time between those points was 5 days, though in-transit time might range up to 7 to 10 days. This uncertainty of time of arrival of cars at terminal elevators and mills also was given as a contributing factor in the diversion of grain transportation from railroads to motortrucks.

Although flour and feed mills stressed line haul and switching time as important incentives for using trucks, service factors not present in country and terminal elevator operations were also important to them.

During years of short crops mills may compete intensively for the supply of grain produced in a particular growing area. This type of competitive situation is well illustrated by the 1951 wheat crop in southwest Oklahoma. The wheat crop in both Texas and Oklahoma was severely reduced by adverse weather. North Texas mills competed intensively for the wheat grown in that area, it being of the grade and protein content needed for their flour blend. Rather than risk losing part of that crop to other markets, the mills were reported to have paid premium prices to have the grain trucked in quickly. Consequently, the major part of that crop moved into terminal position by motor carrier, much of it directly from the farm. Thus, the speed and flexibility of the motortruck was used by the mills in an effort to gain a competitive advantage.

Some mills claimed that the motortruck was superior to other forms of transportation for the transfer of inventories from their line elevators to the mill and between mills. One firm regularly moved grain from one of its interior elevators to a company mill about 300 miles away. In preference to deadheading the trucks back to the elevator, the trucks were utilized to carry family flour on the return haul for local distribution at the point of origin. If flour was not needed, the trucks then obtained a return load for at least a part of the distance by picking up unprocessed grain from the company's line elevators, other elevators, or direct from the farmer.

All but one of the flour and feed mills surveyed used motortrucks for the distribution of milled products. This practice is general throughout the industry. Other than bakery flour, which is purchased largely in carload lots, family flour and feeds sold in this area moved predominantly in less-than-carload quantities. Trucking operations were, therefore, better adapted to the service requirements of flour and feed mills for the delivery of their end products in accordance with customer buying habits or preferences. Truck fleets operated on regular schedules and served customers within a radius of from 200 to 600 miles of the mill, the schedules depending upon the

type and size of operation and the marketing area served. As noted earlier, the trucking equipment was often used to transport return loads of unprocessed grain, feed ingredients, spare parts, or other items used by the company.

Boxcar Shortage

Transportationwise, one of the principal problems in the marketing of grain and mill products has been the timely provision of adequate transportation equipment for the movement of grain and grain products. This has been so particularly for the movement of grain during periods of peak transportation demand that occur during the harvest season. Over the years recurring shortages of rail boxcars have been extremely serious, especially the better class of carrier equipment that is required for the protection and shipment of grain, in the Southwest and in other regions. These equipment shortages have extended all along the line--from the producer through every point in the marketing channel through which grain and mill products pass on the way from the field to the consumer. The economic consequences of this situation have at times been serious. Interruption in the orderly movement of grain and mill products through the marketing channel has brought about economic loss to the farmer, the grain merchant, the miller, the feeder, and the railroads.

The problem of adequate boxcar supply for the movement of grain in the Southwestern States has not been acute since 1949. The shortages in 1950 and 1951 were more spotty or local than general. In fact, the majority of the respondents interviewed in the survey stated that during the past 2 years car supply generally had been satisfactory. These same operators expressed the view that shortages were experienced almost continuously for many months during a good crop year. The failure of a serious car shortage to materialize in 1950 and 1951 probably resulted from drastically reduced production of wheat and other grains in the Southwest and the movement of a considerable proportion of the crop to market by truck. In short, the lack of pronounced car shortages apparently reflected a short crop and the decline in demand for rail transport services rather than a greater ability of the railroads to furnish additional equipment for the movement of grain.

The two preceding sections show that reasons other than and in addition to boxcar supply currently provide strong motives for shipper use of alternative modes of transportation for shipping grain. Even so, many elevators and mills transported grain by truck principally because, small crop notwithstanding, they did not receive boxcars in sufficient quantity and when needed to meet their day-to-day business requirements. Despite the fact that "boxcar shortage" ranked third as a reason for shipping grain by truck, it accounted for nearly 20 percent of total first choice and more than one out of every six of the total number of reasons given for trucking grain. It should be

pointed out, however, that the shippers' reasons for selecting a particular transportation agency may change with time and in accordance with the exigencies of the current situation. That is to say, had this survey been conducted during a normal harvest period, car supply may well have been the most pressing reason for the use of trucks, with price and quality of service considerations of but secondary importance.

Among country elevators boxcar shortage ranked second only to the rate factor as the principal element in selecting the mode of transport used. The emphasis placed upon an adequate supply of boxcars by country elevators is understandable. They are the first commercial business to feel the impact of the new harvest, and they must be prepared to feed the new grain into the market in a continuous stream. It was brought out in an earlier section that limited storage capacity and reliance upon fast turn-over of grain receipts are characteristic of country elevator operations.

Although many country elevators indicated a preference for truck transportation of grain, others said they shipped grain by truck solely because boxcars generally were not available in numbers sufficient to move the volume of grain they were called upon to handle. In this connection, elevator location appeared to have an important bearing upon the adequacy of car supply. Country elevator complaints of boxcar shortage were voiced more often and louder, the more remote the elevator was from a main line. Those country elevators served by more than one railroad were best satisfied with car supply and were the least users of trucks. For those concerns carrier competition for the business tended to insure an adequate boxcar supply.

Boxcar shortages appeared to be of great concern to terminal elevators. Basically, they are in a better position to obtain boxcars than are country elevators, both from the standpoint of location and size of operation. Because of the scale of operations, however, the number of cars placed at their disposal may be substantially below their daily requirements for shipping.

Terminal elevators depend in large part on arriving shipments of grain for their boxcar supply to handle outbound traffic. Thus, the presence of severe car shortages at country points will be felt also at the terminal elevators. These same considerations affecting boxcar supply are applicable to the mills. These concerns obtain a considerable proportion of their cars for loading outbound shipments of flour, feed, and other mill products from boxcars arriving from country and terminal elevators. This relatively steady pool of boxcars is supplemented by such additional cars as the shipper may require and the railroad is able to provide.

The Southwestern States produce two principal grain crops--wheat and sorghum. Corn is important also in some areas. The winter wheat harvest normally begins about the last week in May in central Texas and moves northward into east central New Mexico, southwest Oklahoma, and northwest Texas. By the end of June the harvest is completed. In a good crop year, 125 to 150 million bushels of winter wheat requires transportation from the farm into storage position. This is followed by the sorghum and corn harvest, which begins about the last week in September and continues until mid-November. In the 1950 crop year the 3-State production of sorghum and corn sold commercially amounted to approximately 175 million bushels. From an over-all viewpoint there is a high level of demand for transportation equipment to move grain for about 7 months out of each year.

The legitimacy of shippers' claims of inadequate boxcar supply finds substantial support in figure 8, which shows the weekly surplus and shortage of boxcars in the southwestern railroad district for the postwar years 1946-51. 4/ Each year the period of greatest surplus occurs about mid-May. This is the result of the build-up of car supply in anticipation of the wheat harvest. In the several weeks following the start of the harvest, there is a precipitous decline in available boxcars. By the end of the wheat harvest serious car shortages appear. The boxcar shortage reaches its peak toward the end of the sorghum and corn harvest.

4/ The following considerations must be kept in mind in the interpretation of figures 8 and 9. The area included in the survey lies in both the centralwestern and southwestern railroad districts. It was not possible to allocate boxcar surplus and shortage in the centralwestern district in a manner to assign the pro rata share of car supply in that district to the three Southwestern States. Consequently, the weekly car supply reports of the Santa Fe System and the Rock Island Lines, both important grain carriers in the Southwest, are omitted. This statistical defect in the data is not regarded as serious since the weekly pattern of boxcar surplus and shortages in both railroad districts is practically identical. The differences are quantitative. A further qualification in the use of the data is that the reported weekly surplus and shortage are for boxcars for loading all classes of traffic. The graphs do not and are not intended to reflect car supply available for grain transportation only. Moreover, from a statistical viewpoint, the reported surplus or shortage of boxcars at any time is the result of the judgment of the local freight traffic agent. When demand is heavy, he is reluctant to report any empty car as surplus. Conversely, when demand is slack, he is prone to report almost all empties as surplus. This propensity may tend to exaggerate the peaks and valleys shown in the graphs. In view of these limitations a quantitative analysis of the data is not here undertaken.

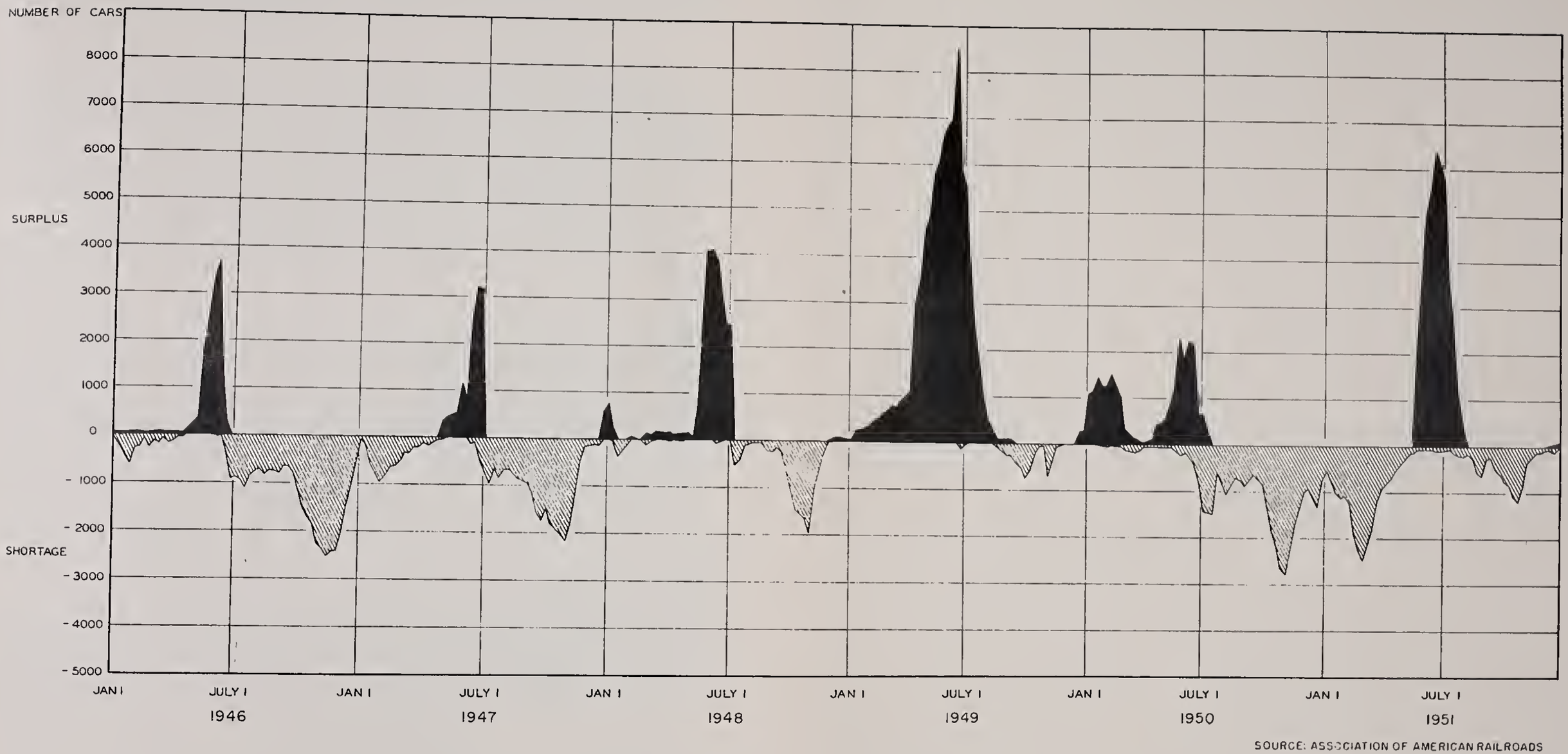


Figure 8.--Weekly surplus and shortage of boxcars in the southwestern railroad district for the years 1946-51.

The graph shows that during some weeks both surpluses and shortages exist. This situation occurs because shortages are not only a matter of demand for boxcars but are also the result of geographic location of the available car supply. Even in periods of minimum demand temporary local shortages may appear. The general impression given by the graph is that boxcar supply is one of feast or famine. For the shipper of grain the famine occurs in the period of greatest demand for the transportation of his commodity.

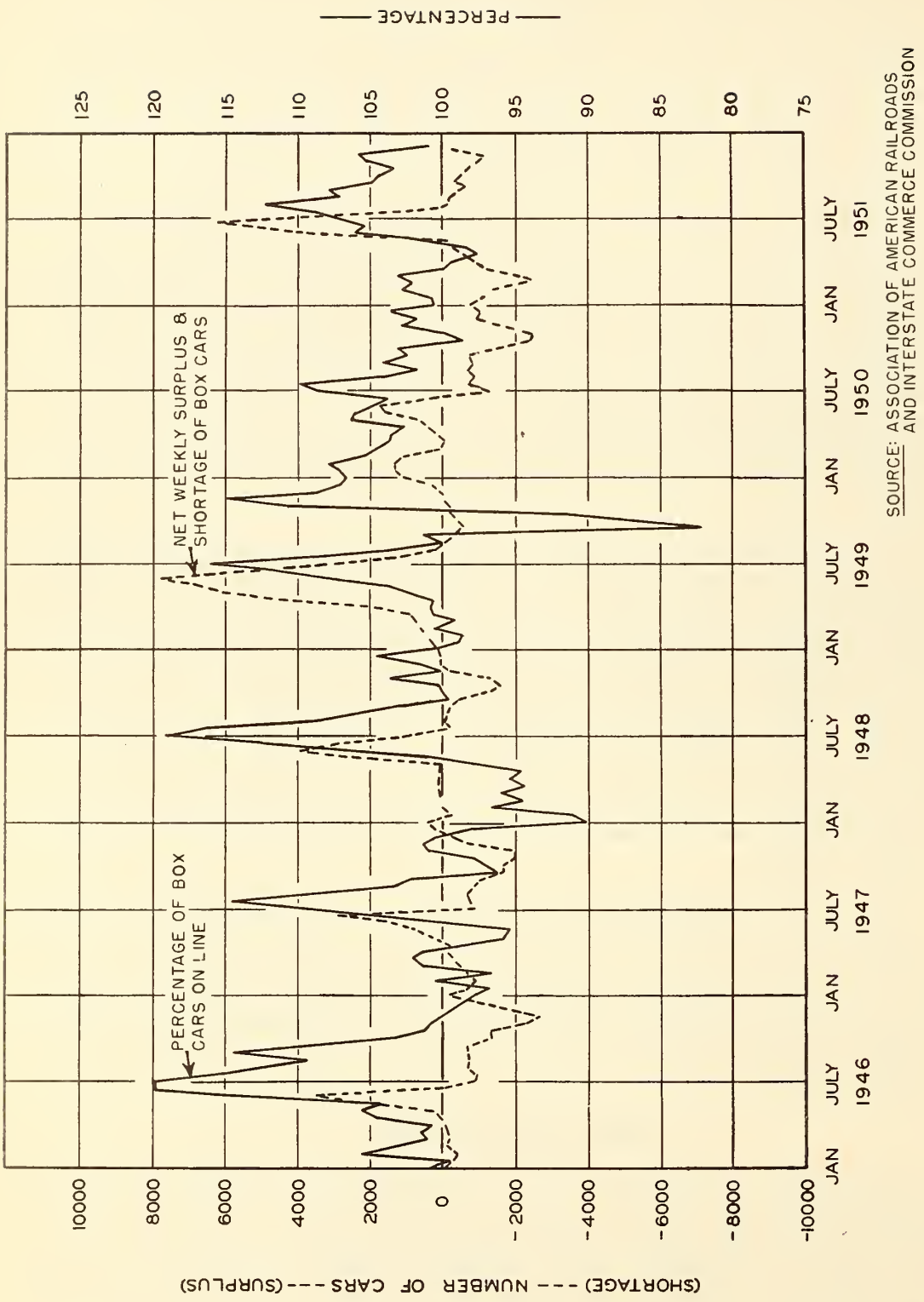
In figure 9, the surplus and shortage of boxcars have been reduced to a net figure and are correlated with the percentage of boxcars on line to number of cars owned by railroads operating in the southwestern district. Two significant facts stand out. The preharvest surplus of boxcars is built up by the return of off-line cars to the southwestern railroads, plus an increment of cars from roads outside the district. Since 1946, the trend in peak percentage of cars on line has been downward. Of course, the total demand for boxcars to transport grain was substantially less in 1950 and 1951 than in earlier crop years, so that fewer cars were needed for the crop movement Even so, the shortage in boxcar supply persisted from July onward in each year.

The second fact to be noted is the high correlation between the disappearance of car ownership on southwestern roads and the appearance of car shortages. Apparently, as the grain moves by rail into terminal positions, a sizable proportion of the cars are not retained in the southwestern district. This is because part of the grain that moves into the southwestern terminals is shipped to eastern mills and ports for export. At the same time ex-district shipments of mill products are taking place. Many of these cars are then usually lost for the balance of the harvest season. Thus, the preharvest boxcar supply in the district rapidly disappears, and the point is soon reached when the pool of empty cars in the territory is totally inadequate to meet the shipper demand.

A tight car situation may be created in ways other than by traffic flow and the failure to return cars for further grain service. It may be created by the shippers themselves. Some shippers, as a protective measure, order cars earlier than needed; others order more cars than are needed. Such practices have the effect of creating an imbalance in car distribution and tend to waste valuable car days of service to the detriment of other shippers and the carriers.

Lower Handling Costs

Twenty-three respondents stated that the lower cost of loading or unloading grain by truck as compared with the cost of loading or unloading by rail influenced their decision to use motor transportation for the movement of grain. Only 1 elevator operator gave this as the primary reason for using trucks, but it is significant that in 22 cases this cost factor ranked either second or third in order of importance. An additional 6 concerns indicated that the manpower savings for



SOURCE: ASSOCIATION OF AMERICAN RAILROADS AND INTERSTATE COMMERCE COMMISSION

Figure 9.--Comparison of net weekly surplus and shortage of boxcars and percentage of boxcars on line to ownership in the southwestern railroad district for the years 1946-51.

loading or unloading through the use of trucks was a consideration in selecting that form of transportation.

These 29 concerns are representative of both shippers and receivers of grain. Of them 13 were country elevators and were concerned primarily with reducing loading costs, 7 were terminal elevators concerned with both loading and unloading costs; and 9 were flour or feed mills that were interested principally in lower unloading costs. None of the country elevator respondents considered the comparative manpower requirements as between rail and truck loading as being very important to their type of operation. On the other hand, 5 terminal elevators and mills attributed their shift to trucks in part to local labor shortages or the inability to attract workers to that kind of work during this period of full employment.

Comparative Manpower Requirements and Direct Labor Costs for Loading Grain by Rail and by Truck

It has been noted elsewhere that the typical country elevator is operated by one man--the owner-operator--or, in the case of a line elevator, a manager. During the harvest season additional personnel may be employed, either part time or full time, to ready boxcars for loading and to load the cars. The time required to ready the boxcar for loading will vary according to the physical condition in which the car is delivered to the elevator by the railroad. The actual loading time basically is dependent upon the size (diameter) of the loading spout.

Before the boxcar can be loaded, it must be readied to receive grain. Usually the boxcar must be cleaned out thoroughly and, when necessary, patched up sufficiently to minimize the possibility of loss and damage from leakage of the grain out of the car or from the entry of moisture into the car. The next step is to install "grain" doors, either wooden or paper, in the door opening of the car. The car is then manhandled into position alongside a gravity spout through which the grain is spouted into the car. The final phase of work involves leveling the load, sealing the door, and manhandling the loaded car away from the spout to make way for a new loading.

In contrast to the many operations incident to the loading of boxcars, only three operations are required to load a truck--weighing in empty, the actual loading process, and weighing out full. The tarpaulin is secured over the load by the truck operator after the truck has been weighed out. For the loading of trucks the loading spout is frequently located directly above the elevator scales. This permits the truck driver to spot his equipment upon the scales, at which time the weight of the truck is recorded. The spout is then opened, and the grain is poured directly into the truck. The load may be leveled concurrently with the loading operation since the truck driver can slowly move his truck forward or backward in such

a manner that the load is self-leveling. After loading, the truck is positioned on the scale and the gross weight is recorded.

The breakdown of the time required for loading grain into boxcars and trucks, as shown in table 7, summarizes the results of time studies made by the interviewers at country elevators. 5/ The time required for loading trucks was practically uniform. On the other hand, the loading time for boxcars varied considerably. Therefore, these time requirements reflect the average time consumed for each stage of the loading operation.

Table 7 --Approximate time required and direct labor costs for loading grain into boxcars and motortrucks at country elevators

Operation	Boxcar 1/		Truck 2/	
	Time	Cost 3/	Time	Cost 3/
	Man-minutes	Dol.	Man-minutes	Dol.
Spotting	2	0.05		
Weighing in			2	0.05
Cleaning	5	.125		
Sealing (making grain-tight) 4/	6	.15		
Installing "grain" doors (wooden or paper)	20	.50		
Actual loading	55	1.375	8	.20
Weighing out			2	.05
Pulling away	2	.05		
Total	90	2.25	12	0.30
Number of men used to load	1		1	

1/ Based on 108,000 lbs. or 1,800 bu.
2/ Based on 36,000 lbs. or 600 bu.
3/ Cost based on $1.50 per hour. Loading usually done by owner-operator or manager.
4/ On the basis that 75 percent of cars received other than Class "A" cars.

From the standpoint of loading time, direct labor costs, and simplicity of the loading operation, trucks appear to have a decided advantage over boxcars for handling grain at country points. The principal difference in the time required to load grain in a railroad boxcar and in a motortruck lies in the cleaning and repairing of the car so the grain will not be contaminated or leak out, and the

5/ Observations were made of 63 truck loadings at 14 country elevators and 16 carloadings at 9 country elevators.

installation of the "grain" doors to prevent leakage around the door as well as to prevent excessive pressure on the outer door. Comparison of the figures in table 7 indicates that a truck can be loaded from approximately seven to eight times faster than a boxcar. Thus, the equivalent of 2½ carloads of grain may be loaded out by truck during the time it would take to load 1 boxcar. In short, the productivity of labor is nearly three times greater when employed in loading trucks than when employed in loading rail boxcars.

To be sure, the loading out of grain is not necessarily a continuous operation, and the employment of additional labor may not be required. Even so, the time saving is important since it permits the worker to be employed at other productive tasks.

Types of Grain Unloading Equipment

The method for unloading trucks resembles the loading process in that three steps are involved. Two of these are identical for both operations--the weighing in of the truck and the weighing out to obtain gross, tare, and net weights. The middle operation consists of the physical unloading of the grain accomplished by means of an automatic truck dump similar to those shown in figures 10 and 11. The dump is equipped so that a tractor semitrailer can drive onto the platform and be firmly anchored thereon. The platform, together with the truck, is then lifted to an angle of elevation that will permit the grain to flow freely from the truck into a pit located below the ground (similar to an under-the-track pit used to unload hopper cars). The grain is then elevated into storage bins. Although a truck may be unloaded manually or by power shovel, these methods are used very infrequently.

For unloading rail boxcars, there are two principal types of unloading equipment--the automatic car dumper and the power shovel. Regardless of which type of equipment is used, the unloading operations are basically the same, namely. Spotting the car for unloading; opening the outer storm door of the boxcar; removing the grain door (only one side is necessary) to allow the grain to flow unhampered from the car; physically unloading the contents; sweeping the car to insure the removal of every possible bit of grain; and, finally, pulling the car away to enable another car to be unloaded.

The preponderance of terminal elevators and mills unload boxcars by means of power shovels. 6/ (See. fig. 12.) The power shovel consists of a wood, steel, or aluminum scoop with two handles affixed

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6/ Three elevators used the automatic car dump exclusively; 37 elevators and mills employed 1 or more power shovels for unloading; and 35 of the concerns that used power shovels also had 1 or more truck dumps installed.

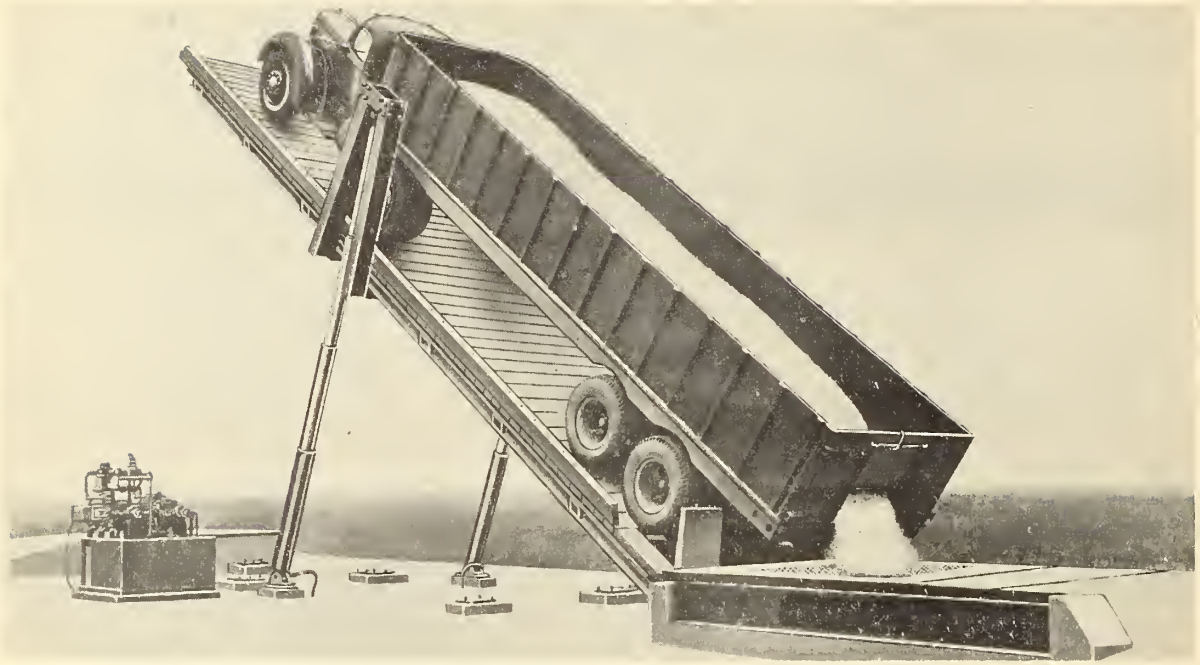
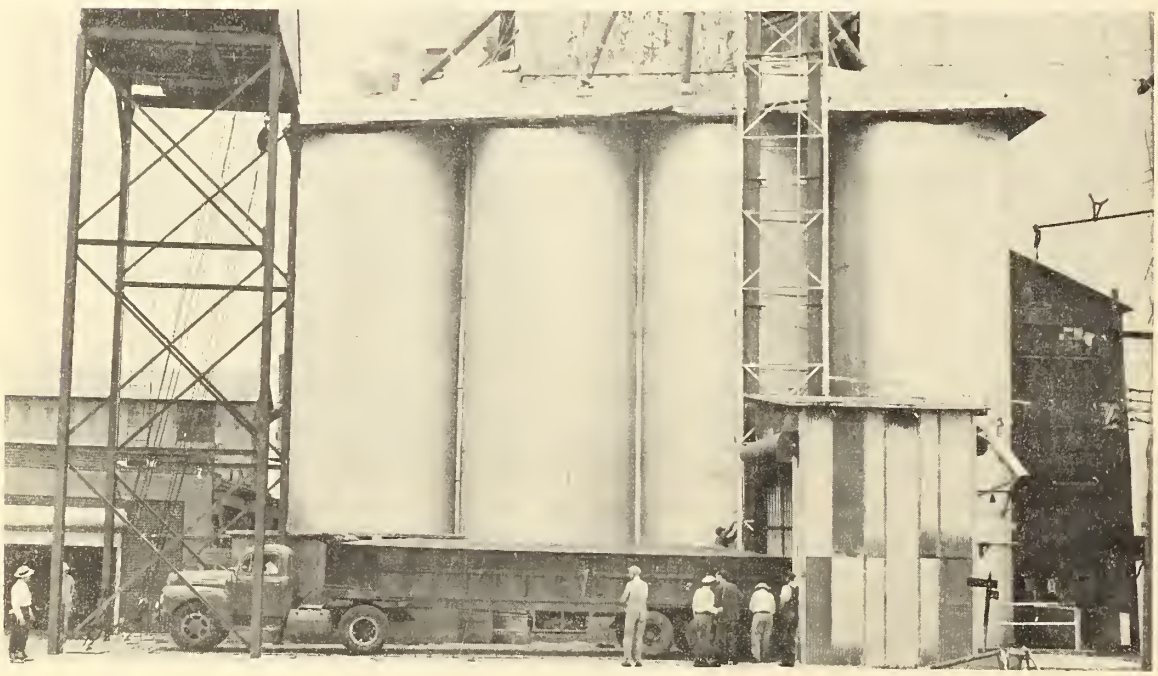


Figure 10.--A hydraulic-type grain-truck dump.



View 1

Figure 11.--Three views of grain-truck unloading operation showing a combination truck scale and overhead cable-type of truck lift.

View 2

View 3

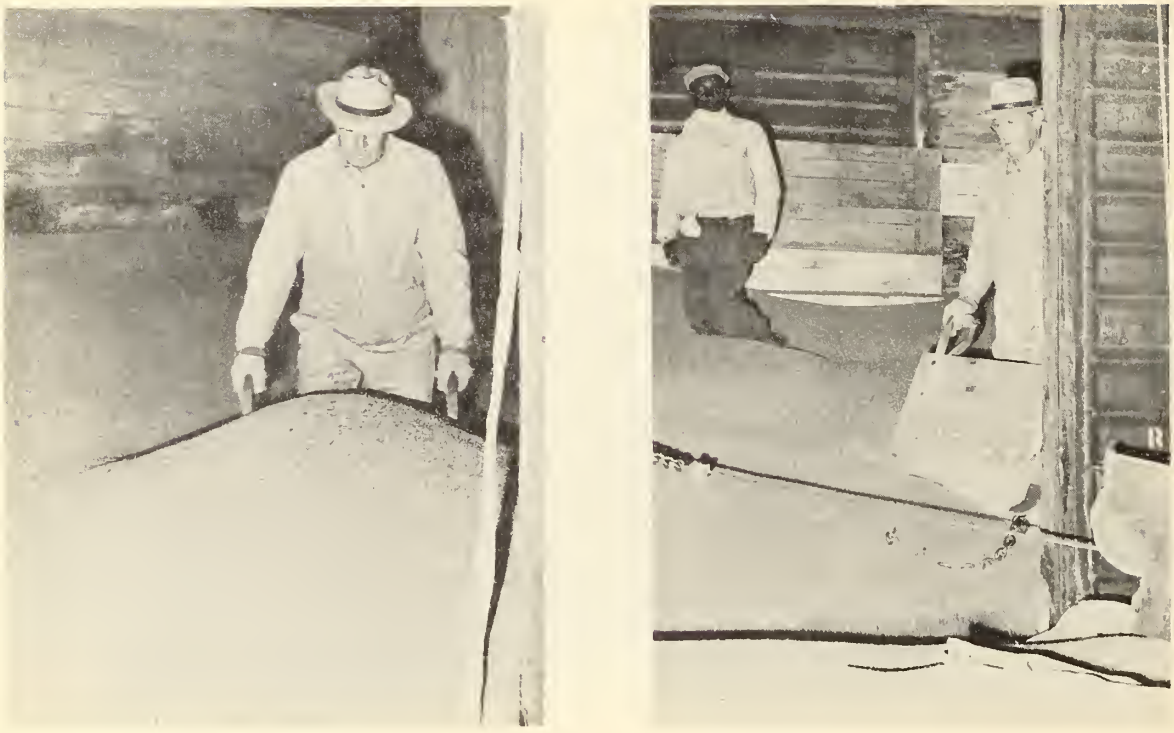


Figure 12.--Grain unloading from boxcars by use of the power shovel.

enabling the operator to hold the scoop securely and place it in position. A cable attached to the scoop passes through a pulley, mounted on the floor of the unloading dock or platform, upward about 10 to 15 feet above the floor, where it winds about a drum set in a shaft mechanism. An operator pulls this scoop backward within the boxcar and inserts the scoop into the grain to be unloaded. This holds the power shovel at a "stop" position. When the operator is ready to start unloading the grain, he gives a sharp jerk on the scoop handles, and this action imparts slack to the cable, causing a clutch to engage the winding spool. The cable is then wound on the drum until the scoop reaches the car door, where it automatically stops. The power shovel is then drawn back into the car, and the operation is repeated until the grain is completely unloaded. Two power shovels may be operated simultaneously at opposite ends of the car, thus necessitating a working crew of four men to a boxcar, or two teams, with teams relieving each other on alternate cars. Before using these power shovel attachments, however, the grain door is removed from the spotted car and the initial surge of grain allowed to drain into the unloading pit. This type of equipment is the most common form found at elevators for unloading grain from boxcars.

The other type of boxcar unloading equipment, the automatic car dump or grain car unloader, is shown in figure 13. It is used only at the larger terminal elevators and mills whose capacity and turn-over

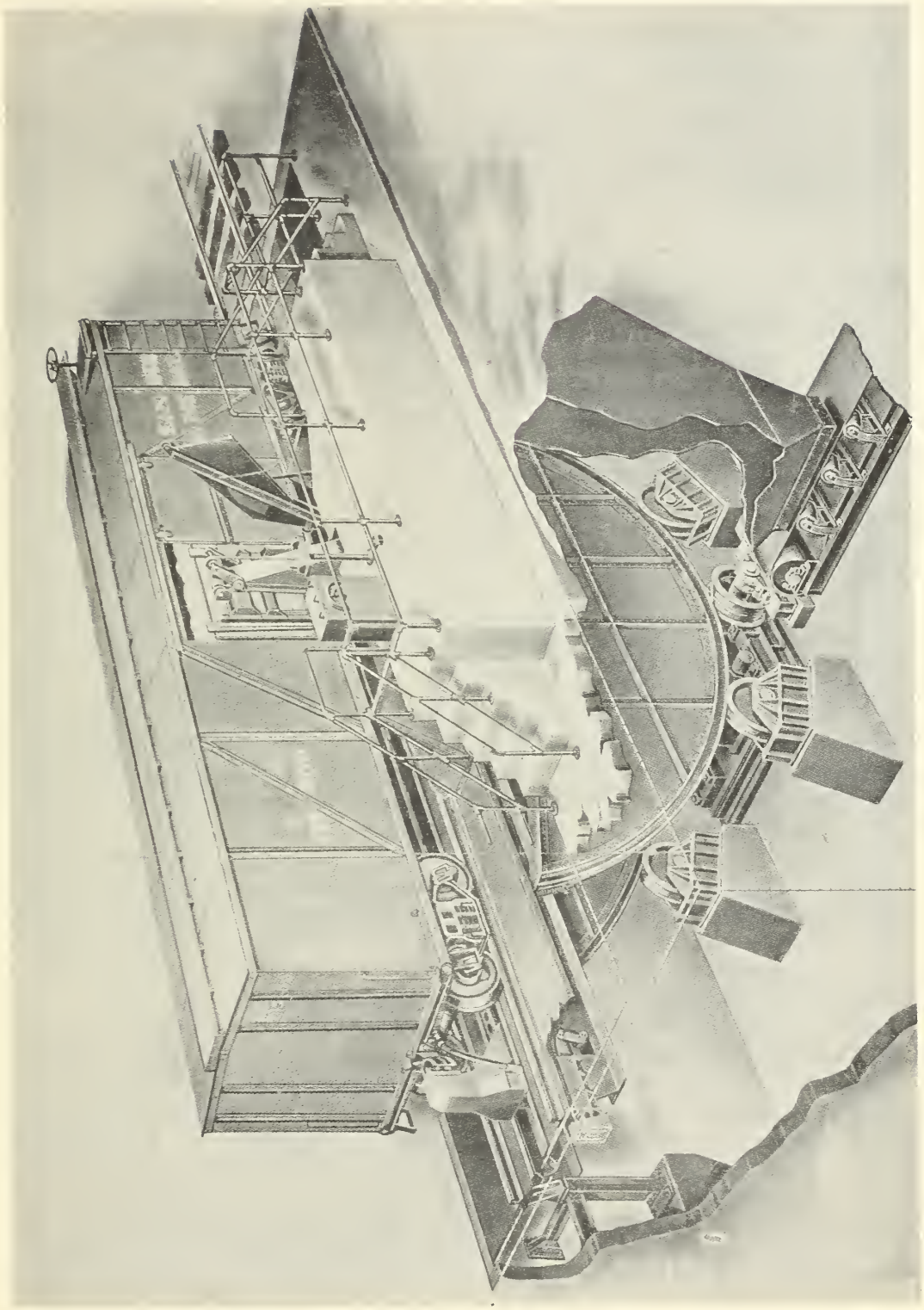


Figure 13.--Cutaway view of one type of grain car unloader.

are of such a volume as to warrant its installation and operation. It is a tremendous piece of machinery, consisting of a structural steel cradle so mounted on rollers at four points as to permit endwise tipping of a boxcar to 40° from the horizontal in either direction; and of a car supporting platform, pivotally mounted to permit sidewise tipping of a car to an angle of 15° in one direction. The combined effect of tipping a car sidewise 15° and endwise 40° (with the grain door removed on the dumping side) causes the entire contents of the car to be discharged through the car door opening into a large steel hopper supported from the foundation.

A boxcar loaded with grain is unloaded by means of the car dumper as follows: The loaded grain car is spotted on the platform of the unloader, with the outer door of the car open on the dumping side. The disappearing end clamps of the unloader are simultaneously brought into position in contact with the car couplers, centering the car on the cradle. The door engaging frame is then brought into contact with the grain door which is held against movement as the car is tipped laterally 15°. The door is thus pulled free of its fastening and held by spikes on the door-engaging frame, above the main flow of grain. After the boxcar has been tipped sidewise 15°, it is next tipped 40° to the horizontal in one direction to discharge the grain from one end of the car, and then to 40° in the opposite direction to discharge a large portion of the grain from the opposite end of the car. A power-operated baffle plate is then inserted through the door opening and the cradle tipped once again 40° in the direction of the first endwise tip to discharge the remainder of the grain in the car. After the car has been emptied of its load, the car-supporting platform with its empty car is again brought to a normal horizontal position. With the car righted, the door opener frame is removed from the car and the grain door falls on the car floor. The end clamps are withdrawn into their pits, which operation automatically locks the ends of the car-supporting platform.

Comparative Time Required and Direct Labor Cost for Unloading Grain by Rail and by Truck

Table 8 compares the time required and direct labor cost incurred for unloading grain by each of the methods just described. 7/ The analysis shows that the automatic boxcar dump and the truck dump operated at the same relative labor time requirements. The truck unloading operation averaged 10 minutes per truckload of grain with a direct labor cost of 21 cents. In terms of a carload equivalent, unloading by truck required 30 man-minutes at a labor cost of 63 cents. This compared favorably with grain unloading from boxcars when using the automatic car dump. Although the latter unloading operation consumed only 7 minutes, the total increment of labor applied to the unloading operation used 28 man-minutes, or 59 cents direct labor cost.

7/ Observations were made of 14 unloadings at 3 elevators employing the automatic car dump; 38 unloadings at 5 elevators using power shovels; and 57 truck unloadings at 12 elevators employing truck dumps.

Table 8.--Approximate time required and direct labor costs for unloading boxcars and motortrucks at terminal elevators and mills

Operation	Boxcar 1/				Truck 2/	
	Automatic dump		Power shovel		Automatic dump	
	Time	Cost 3/	Time	Cost 3/	Time	Cost 3/
	Man-min.	Dol.	Man-min.	Dol.	Man-min.	Dol.
Spotting	4	0.084	4	0.084		
Weighing in					2	0.042
Opening storm door			4	.084		
Removing grain door (wooden or paper)			8	.168		
Unloading	20	.42	96	2.016	6	.126
Sweeping			6	.126		
Cleaning			6	.126		
Weighing out					2	.042
Pull away	4	.084	4	.084		
Total	28	0.588	128	2.688	10	0.210
No. men used to unload	4		4		1	

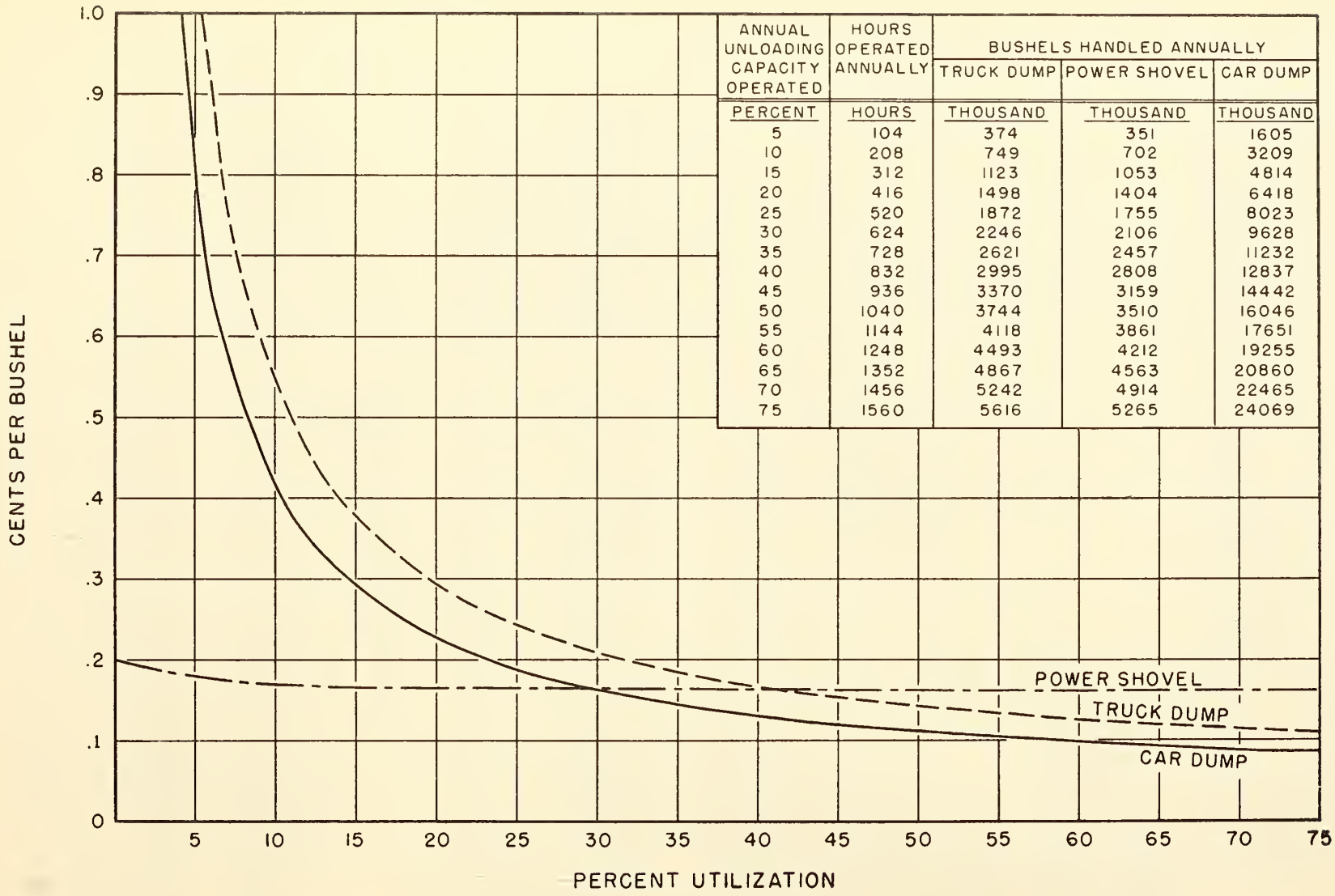
1/ On basis of 108,000 lbs. or 1,800 bu.
2/ On basis of 36,000 lbs. or 600 bu.
3/ Cost based on unskilled labor rate of $1.26 per hour.

Power shovels were the most common form of equipment used for unloading grain from boxcars. When this type of unloading equipment was used, seven distinct operations had to be performed. As shown in table 8, the average time required to unload was 32 minutes with a working crew of four men to a boxcar. Total man-minutes employed was 128, and the direct labor cost totaled $2.69. From the standpoint of working time and labor costs involved, unloading grain by means of power shovels appeared to be substantially less efficient than the automatic car dump and truck dump.

Operating Costs for Various Types of Unloading Equipment

A general idea of the cost of unloading grain employing each of the three principal types of unloading equipment may be had from figure 14. The operating costs shown in the graph are stated in cents per bushel for different levels of equipment utilization.

Unloading costs per bushel of grain decline very rapidly with increased utilization for both the car dump and truck dump. This is accounted for by the assignment of annual depreciation charges to



ANNUAL UNLOADING CAPACITY OPERATED	HOURS OPERATED ANNUALLY	BUSHELS HANDLED ANNUALLY		
		TRUCK DUMP	POWER SHOVEL	CAR DUMP
PERCENT	HOURS	THOUSAND	THOUSAND	THOUSAND
5	104	374	351	1605
10	208	749	702	3209
15	312	1123	1053	4814
20	416	1498	1404	6418
25	520	1872	1755	8023
30	624	2246	2106	9628
35	728	2621	2457	11232
40	832	2995	2808	12837
45	936	3370	3159	14442
50	1040	3744	3510	16046
55	1144	4118	3861	17651
60	1248	4493	4212	19255
65	1352	4867	4563	20860
70	1456	5242	4914	22465
75	1560	5616	5265	24069

Figure 14.--Cost per bushel of grain handled for various types of unloading equipment at different levels of utilization.

more hours of work. On the other hand, the cost of unloading by power shovel is inflexible for all levels of operation. Depreciation charges for this type of equipment are negligible, whereas labor costs per bushel of grain unloaded are constant.

For unloading cars the power shovel is cheaper than the car dump up to about 30 percent equipment utilization where the cost of unloading by these two methods is the same. &/ However, there is a substantial difference in the amount of grain that can be unloaded by each type of equipment. Better than 9.5 million bushels of grain can be unloaded by the car dump as compared with only 2.1 million bushels when the power shovel is used. At this same level of utilization approximately 2.5 million bushels may be unloaded by the truck dump, but the per-bushel unloading cost is roughly one-third greater than for the two types of boxcar unloading equipment. When the car dump is used more than 30 percent of the time, it is cheaper to use it than to unload with the shovel.

The cost of unloading boxcars by power shovel and trucks by truck dump is the same when each type of equipment is used about 40 percent of annual operating capacity. This equalization of operating costs is accounted for wholly by the decline in unit unloading costs of the truck dump. At 40 percent utilization the volume of grain that may be unloaded by each of these types of equipment is approximately the same--3 million and 2.8 million bushels respectively--for the truck dump and power shovel. The car dump is capable of unloading nearly 13 million bushels of grain at a 40-percent level of annual operations, at some 25 percent less cost.

The car dump is probably the best type of boxcar unloading equipment for the firm that handles a large volume of grain with a rapid turnover, both from the standpoint of the rate and the cost of unloading. Moreover, the employment of mechanical handling equipment for unloading tends to reduce labor turn-over since the work is somewhat less dirty and less fatiguing than manual unloading.

On the other hand, there are a number of factors that militate against the extensive use of the car dump by the grain trade. The foremost disadvantage appears to be the very high capital cost of the equipment. Not many concerns are willing or able financially to make such a large investment in unloading facilities. Moreover, only a few firms annually handle the volume of grain necessary to

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&/ The per-bushel cost of operating the car dump is understated by some fraction of one mill since maintenance and power costs were not included in car dump operating costs. See Appendix, footnote 5, table 16.

justify its installation. Unless the firm regularly handles a large volume of grain, the equipment will not pay itself out. Then there is the availability of alternative unloading devices from which the business may choose that will satisfactorily serve its needs.

The power shovel seems to be the most economical type of unloading equipment for unloading boxcars at elevators where the volume of grain handled is relatively small. It was learned, however, that labor turn-over today is a continuing problem of the firm that employs this type of boxcar unloading equipment. The manual unloading of grain is exhausting and dirty work when the power shovel is used.

The cost per bushel of unloading grain from trucks by use of the truck dump is somewhat higher than for unloading grain from boxcars by power shovel when the volume of grain handled is less than 3 million bushels. Even so, the elevator operator may very well find it more advantageous to receive trucked grain rather than rail shipments because the added cost of the unloading operation may be compensated for by the smaller labor requirements and smaller turn-over in employment.

The covered hopper car is the only type of railroad equipment that compares favorably with the motortruck in the ease and speed with which it can be unloaded without requiring a substantial investment in unloading facilities. Although this type of car was not observed loaded with grain during the survey, time studies on the unloading of the covered hopper car conducted in 1950 show that the car may be unloaded by two men in about 5 to 7 minutes. This rate compares favorably with the unloading time for the automatic car dump, but uses only one-half as much manpower. In terms of man-minutes, the unloading operation is on a par with the unloading of trucks. However, the quantity of grain unloaded from the covered hopper car is equal to approximately three truckloads.

This type of car has been used by the railroads only for emergency transportation of grain during critical periods of boxcar shortage, and their general use for the movement of grain has not been regarded favorably by the carriers because the ratio of empty to loaded mileage is higher than on boxcars.

Profit from Trucking Operation

Profit from the trucking operation was given as the primary reason for trucking grain by eight concerns that operated their own truck or truck fleets. Four firms selected this reason as second choice and two as third choice. Upon discussing the profit motive as an incentive for using trucks, it was found that the term was used generically; that is, they used trucks because they believed that the efficiency of truck transportation enabled them to increase the net return of the business operation. From an accounting point of view respondents either did not know or would not divulge their truck operating costs. Judging from

the interviews, it appeared that none of them used accounting methods that would permit accurate segregation of all expenses properly chargeable to company trucking operations on a current basis.

The criteria used for measuring the profitability of private trucking operations were varied. One country operator said that he was compelled to use his own trucks in order to compete effectively with the itinerant grain trucker to whom he was losing a substantial part of his business. His farmer customers agreed to give him the opportunity to bid against the merchant trucker for their grain. In this manner he claimed to have eliminated that type of competition. Not only did he pick up the farmer's grain at the farm and haul it direct to flour and feed mills, but he also used his trucks to transport the grain from his elevator to those concerns. The trucks returned loaded with fertilizer, binder twine, fence posts, and other commodities, which he distributed directly to his farmer customers. In his mind this operation was definitely profitable. It enabled him to meet other competition; permitted diversification of his business; and expanded the dollar volume of business done by his concern.

Another criterion used to measure the profitability of private trucking operations was on the basis of a comparison of private trucking costs with railroad, contract carrier, or itinerant trucker rates. Rate comparisons were analyzed in detail in the section dealing with that subject. It suffices here to point out that any savings obtained by the elevator operator because of trucking costs being lower than the prevailing freight charges were considered a profit directly attributable to the trucking operation.

Flour and feed mills were found to operate the largest truck fleets. Mill products were distributed by trucks chiefly because of service advantages over rail transportation. Promptness of delivery, direct mill-to-store delivery, flexibility of operation, and frequency of schedule, all of these service factors establish an economic need for trucking services for the distribution of products in this highly competitive field. However, the use of the trucking equipment for moving inventories between elevators and mills makes possible fuller utilization of equipment and lowers the transportation cost per unit of traffic. Firms that use their own trucking equipment stated categorically that when they have only a one-way haul their truck-operating costs per unit of grain transported almost equals the rail rate. When a return load is obtained, operating costs per unit of traffic are reduced substantially below either the rail rate or contract trucker rate.

There is no intent on the part of the mills to profit from the motortrucking operation as a separate business enterprise. Rather, they operate their own fleet of trucks because they believe that such operation not only furthers the efficient operation of their milling business but also is a necessary part thereof.

Increase Volume of Grain Shipped

Fifteen elevators and mills stated that their principal reason for shipping grain and mill products by truck was to increase the volume of business they could handle. For country elevators the use of trucks meant that during the harvest season grain could be moved into and out of the elevator quickly and with regularity without fear of the elevator being blocked because of lack of boxcars. Also, the trucking of grain was cited as a means of the country elevator operator broadening his trade outlets, because the flexibility of trucking operations permitted a wider trade area to be served. By selling to itinerant or merchant truckers he obtained an additional volume of business over that handled through established trade channels--grain brokers and merchants.

Flour and feed mills likewise indicated that the trucking of grain into their mills permitted them to handle a greater volume of grain and broadened the area from which they could draw their grain supply. Trucks have long been used by mills to distribute their end products. However, the ability of many concerns to obtain return loads of grain has served to extend the range of distribution for their mill products.

Other Reasons for Trucking Grain

Various miscellaneous reasons for trucking grain were grouped as "other reasons." Collectively these varied reasons ranked sixth; individually, they would be of lesser relative importance. They are "competition," "customer preference," "lower inventories," "balance out transit," and "less loss and damage." Each of these motives for using trucks to transport grain has been referred to in the preceding discussion; hence they are presented here only in summary form.

Competition.--The competition referred to here concerns itself not with carrier competition for the grain traffic but with competition between the elevators and mills. For example, even though a concern may prefer to ship or receive grain or mill products by rail, it may transfer some portion of its grain traffic to the highway in order to compete successfully with another elevator or mill serving the same general trade area; otherwise, the competitive advantage will lie decisively with the other firm.

Customer preference.--This reason was cited by flour and feed mills to explain the use of truck fleets and contract carriers for the delivery of flour to their trade outlets. Two principal types of flour are milled--bakery flour and family flour. For the most part, bakery flour moves in carload lots into terminal distributing points or directly to bakeries. On the other hand, family flour is sold to wholesale distributors and retail outlets that prefer to make frequent less-than-carload purchases. This customer preference for frequent deliveries in small quantities is best satisfied by the use of the motortruck.

Lower inventories.--Several large mills indicated that the use of trucks for the movement of grain had resulted in reducing inventory requirements at their mills by facilitating the transfer of grain between their country and terminal storage points and mills.

Balance out transit.--The transit privilege enables grain to be shipped from point of irigin to some intermediate point, there to be stored, marketed, or processed, and later reshipped to destination at a rate less than the combination of the separate rates from point of origin to the transit point and from there to destination. An imbalance of transit arises when more grain arrives at flour mills under the rail transit privilege than is shipped out. The mills, therefore, find it cheaper to truck in grain in quantities equal to the flour equivalent delivered by truck than to pay the local rail rate.

Less loss and damage.--All the respondents interviewed reported that loss and damage when grain is shipped by truck is negligible as compared with when it is shipped by rail. Not only was the reduction of this risk factor important to the grain trade, but also the elimination of the necessity for filing claims and negotiating settlement was important. In this respect, the difficulty of getting claims settled quickly and on a basis agreeable to the parties concerned prompted several firms to investigate the advisability of purchasing their own truck fleet.

INDUSTRY OBJECTIONS TO THE TRUCKING OF GRAIN

The preceding sections have dealt at considerable length with the reasons for using trucks for the transportation of grain. This section sets forth the objections stated by both users and nonusers of motor vehicles to the use of that method of transportation. Although only 29 percent of the firms interviewed objected to grain trucking, their views are significant. Just as the earlier sections relating to positive reasons for truck use serve to focus attention on shippers' views of certain shortcomings in rail services, this section attempts to point up the shippers' views against the trucking of grain.

In summarizing shipper objections, it was found that of the 117 elevators and mills interviewed, 34 concerns stated one or more objections to the use of trucks. The other 83 concerns offered no objections. By type of business operation the scoring indicates that, percentagewise, more subterminal and terminal elevators gave reasons for not using trucks than any other type of enterprise. Of the 13 terminal elevators surveyed, 6, or 46 percent, expressed one or more objections. Of the 77 country elevators canvassed, only 20 concerns, or 26 percent, had any objection to the use of trucks. One-fourth of the 12 feed mills interviewed gave reasons against trucking grain, whereas among the 15 flour mills surveyed, one-third of the respondents expressed disapproval of the use of motor vehicles.

A total of 66 objections was stated by the 34 concerns, with 3 negative reasons accounting for more than 90 percent of the responses. In table 9 the scores are weighted, and for comparative purposes the rating for each objection is assigned for each type of business operation and for all concerns.

Unethical Business Practices

The foremost objection raised against trucks was that of the unethical business practices engaged in by the truckers. Of principal concern to the grain trade was the forging of bills of sale by the trucker and subsequent sale of the grain for his own account. The repercussions from this type of transaction can readily be seen. The trucker profits by receiving payment for a truckload of grain to which he had no title; the farmer or local elevator loses entirely the grain surrendered to the trucker for delivery and with it his income; the consignee who contracted to buy the grain never receives it; and the elevator that did buy from the trucker actually, though unknowingly, purchases stolen property.

Some country elevator operators said that they had been victimized by merchant truckers who gave them noncertified checks in payment for a truckload of grain. In due course these personal checks were returned to the elevator operator's bank marked "No record of account" or "Insufficient funds." Although these country elevator operators did not object to the trucking of grain, they did object strongly to having business dealings with the merchant trucker except for cash.

Table 9.--Composite rating 1/ of objections to transporting grain by truck according to type of business operation

Objection	Country elevator	Terminal elevator	Flour mill	Feed mill	All concerns Rating	All concerns Rank
Unethical business practices	83	21	18	7	129	1
Disrupts existing marketing channels	45	22	14	5	86	2
Lack of transit privilege	23	12	8	8	51	3
Complicates rate structure	7	-	-	-	7	4
Difficulty of inspection and sampling	-	3	-	4	7	5
Increases billing and accounting	-	5	-	-	5	6

1/ Scoring in table 10 of the Appendix is arranged by type of business operation and weighted by assigning a rating of 4 points if objection was first choice, 3 if second choice, 2 if third choice, and 1 point if fourth choice. It is realized that any method used for weighting these data would be arbitrary, and the weights used here are merely a convenient method of giving some approximation of the relative importance of each reason to each type of business concern.

Disruption of Existing Marketing Channels

The second major objection to the use of trucks for hauling grain was that this type of movement disrupted the existing marketing channels. It will be remembered that the transportation of grain is a series of steps: From farm to country elevator, country elevator to terminal elevator, and terminal elevator to mill for processing and distribution. This was, and still is, the customary channel in the marketing of grains; however, trucks have been instrumental in altering this marketing channel to some extent.

In buying the grain directly from the farmer, the trucker naturally sets about to obtain the best possible price for his delivered grain, either at a terminal elevator or a mill, but certainly not at a country elevator. The effect of such movements on the local elevator operator is obvious. Because he is bypassed completely, his handling charge for the services he performs (cleaning, storing, shipping) is entirely eliminated. The country elevator is affected most by the trucking movement, but terminal elevators, in many instances, likewise are bypassed by the movement of grain directly to the mills. The services usually performed by the terminal elevator (cleaning, storing,

mixing, grading) can be just as readily accomplished by the mill; consequently, whenever it is profitable to the truckers, the grain will move direct from farmer to mill.

One important effect that the trucking of grain may have on the conventional marketing channels for grain was not mentioned by any of the individuals interviewed. It was explained at the beginning of this report that the movement of grain from each area of production is oriented by the rail freight rate structure into particular markets. The trucking of grain, being independent of the rail rate structure, tends to break down the established traffic flow of grain between producing areas and terminal markets. This situation is illustrated by the development of the substantial truck movement of sorghum grains from Texas and New Mexico to California instead of into Texas markets; the direct movement of both sorghum and wheat from New Mexico, the Texas Panhandle, and Oklahoma to the Gulf ports; and more particularly, the movement of grain produced north of the Red River into Texas terminals instead of into Kansas and Oklahoma terminals.

Lack of Transit Privilege

The third major objection to trucks was the absence of the transit privilege. As pointed out previously, grain can be shipped by railroad to a transit point for storage, cleaning, or processing, and the grain or product moved to a destination beyond at the balance of the through rate. On this type of service trucks cannot compete since they do not offer shippers and consignees such privileges. Transit is a characteristic of railroad transportation that has not been adopted by grain truckers, and in the case of grain it is a highly significant one.

Other Objections to Trucking Grain

The remaining three objections apparently were of but minor importance to shippers. The objection to trucks from the viewpoint that grain trucking complicates the existing freight rate structure stems largely from the instability of truck rates and the resulting uncertainty in determining transportation charges. In view of the fact that only two country shippers gave this reason, the objection appears to be of no great consequence.

One terminal elevator and one feed mill objected to the trucking of grain because of the inspection problem it created for them. Unlike the other objections, this is a personal one and should be evaluated in terms of the individual concern. Other elevators appeared to have met that problem satisfactorily, and these two firms could do likewise.

There is little doubt that grain shipments by truck do increase the amount of billing and accounting done by the business. Evidently this added general expense is more than compensated for by the economies of trucking grain. Only two terminal elevators gave this objection, and it was of small import to them.

APPENDIX

Table 10.--Percentage distribution of country elevators according to volume of grain shipped by truck

Percentage of total volume shipped by truck	Country elevators	Storage capacity	Grain handled in 1950	Grain trucked
	Number	Bushels	Bushels	Bushels
1 - 10	18	5,970,000	9,397,000	622,000
11 - 20	3	864,000	1,332,000	232,750
21 - 30	6	2,940,000	5,384,500	1,345,625
31 - 40	2	525,000	1,070,000	330,000
41 - 50	6	4,111,000	7,923,000	3,936,000
51 - 60	4	1,159,000	2,075,000	1,173,750
61 - 70	-	-	-	-
71 - 80	2	175,000	901,000	678,300
81 - 90	4	925,000	1,460,500	1,299,450
91 - 100	4	840,000	1,304,000	1,270,300
Total - elevators shipping by truck	49	17,509,000	30,847,000	10,888,675
Elevators shipping by truck - quantity unknown	6	1,395,000	2,852,500	
Elevators not shipping by truck	22	4,366,000	6,844,000	0
Total	77	23,270,000	40,543,500	

Table 11.--Percentage distribution of terminal and subterminal elevators according to volume of grain received by truck

Percentage of total volume received by truck	Terminal elevators	Storage capacity	Grain handled in 1950	Grain trucked
	Number	Bushels	Bushels	Bushels
1 - 10	3	9,100,000	10,835,000	632,000
11 - 20		-	-	-
21 - 30	1	2,180,000	5,000,000	1,500,000
31 - 40		-	-	-
41 - 50		-	-	-
51 - 60	2	2,350,000	6,000,000	3,600,000
61 - 70		-	-	-
71 - 80		-	-	-
81 - 90	1	1,525,000	2,620,000	2,227,000
91 - 100		-	-	-
Total - elevators receiving by truck	7	15,155,000	24,455,000	7,959,000
Elevators receiving by truck - quantity unknown	2	3,000,000	4,136,000	
Elevators not receiving by truck	4	28,650,000	36,085,000	0
Total	13	46,805,000	64,676,000	

Table 12.--Percentage distribution of elevators attached to flour mills according to volume of grain received by truck

Percentage of total volume received by truck	Flour mills	Storage capacity	Grain handled in 1950	Grain trucked
	Number	Bushels	Bushels	Bushels
1 - 10	2	8,250,000	16,082,600	1,368,000
11 - 20	1	1,760,000	3,000,000	480,000
21 - 30	4	4,500,000	7,099,500	1,625,000
31 - 40	1	450,000	700,000	275,000
41 - 50	2	3,300,000	6,083,000	3,041,500
51 - 60	-	-	-	-
61 - 70	1	525,000	754,000	485,000
71 - 80	-	-	-	-
81 - 90	-	-	-	-
91 - 100	2	832,000	1,525,150	1,525,150
Total - elevators receiving by truck	13	19,617,000	35,244,250	8,799,650
Elevators receiving by truck - quantity unknown	2	5,518,000	10,832,800	
Elevators not receiving by truck	0	0	0	0
Total	15	25,135,000	46,077,050	

Table 13.--Percentage distribution of feed mills according to volume of grain received by truck

Percentage of total volume received by truck	Feed mills	Storage capacity	Grain handled in 1950	Grain trucked
	Number	Bushels	Bushels	Bushels
1 - 10	-	-	-	-
11 - 20	2	2,750,000	6,143,500	1,061,150
21 - 30	2	2,300,000	4,670,000	1,367,500
31 - 40	-	-	-	-
41 - 50	2	850,000	1,830,000	910,000
51 - 60	-	-	-	-
61 - 70	1	700,000	2,100,000	1,365,000
71 - 80	1	370,000	726,600	661,000
81 - 90	-	-	-	-
91 - 100	-	-	-	-
Total - elevators receiving by truck	8	6,970,000	15,470,100	5,364,650
Elevators receiving by truck - quantity unknown	3	575,000	1,285,850	
Elevators not receiving by truck	1	2,000,000	4,468,000	0
Total	12	9,545,000	21,223,950	

Table 14.- Estimated motortruck operating costs

Distance	Trip cost	Truck mile cost	Equivalent costs in cents per 100 pound: 30,000-lb. pay load with loaded operation 100%	30,000-lb. pay load with loaded operation 50%	32,000-lb. pay load with loaded operation 100%	32,000-lb. pay load with loaded operation 50%	34,000-lb. pay load with loaded operation 100%	34,000-lb. pay load with loaded operation 50%	36,000-lb pay load with loaded 100%	36,000-lb pay load with operation 50%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Miles	Dollars	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
25	10.48	41.9	3½	5	3½	4½	3	4½	3	4
50	14.51	29.0	5	7½	4½	7	4½	6½	4	6½
75	18.54	24.7	6	10	6	9½	5½	9	5	8½
100	22.57	22.6	7½	13	7	12	6½	11½	6½	10½
125	26.60	21.3	9	15½	8½	14½	8	13½	7½	13
150	30.63	20.4	10	18½	9½	17	9	16	8½	15
175	34.66	19.8	11½	21	11	19½	10	18½	9½	17½
200	38.69	19.3	13	25½	12	23½	11½	22½	10½	21
225	42.72	19.0	14	28	13½	26	12½	24½	12	23½
250	46.75	18.7	15½	30½	14½	29	13½	27	13	25½
275	50.78	18.5	17	33½	16	31½	15	29½	14	28
300	54.81	18.3	18½	36	17	34	16	32	15	30
325	54.84	18.1	20	38½	18½	36½	17½	34	16½	32½
350	62.87	18.0	21	41½	19½	39	18½	36½	17½	34½
375	71.90	19.2	24	46	22½	43	21	40½	20	38
400	75.93	19.0	25½	48½	23½	45½	22½	43	21	40½
425	79.96	18.8	26½	51	25	48	23½	45	22	42½
450	83.99	18.7	28	54	26	50½	24½	47½	23½	45
475	88.02	18.5	29½	56½	27½	53	26	50	24½	47
500	92.05	18.4	30½	59	29	55½	27	52½	25½	49½
550	100.11	18.2	33½	64½	31½	60½	29½	57	28	54
600	108.17	18.0	36	71½	34	67	32	63	30	59½
650	116.23	17.9	38½	77	36½	72	34	68	32½	64
700	124.29	17.8	41½	82½	39	77½	36½	72½	34½	68½
750	137.35	18.3	46	89½	43	84	40½	79	38	74½
800	145.41	18.2	48½	95	45½	89	43	83½	40½	79
850	153.47	18.1	51	100	48	94	45	88½	42½	83½
900	161.53	18.0	54	105½	50½	99	47½	93	45	88
950	169.59	17.9	56½	112½	53	105½	50	99½	47	94

Continued.-

Table 14.--Estimated motortruck operating costs-Continued

Distance	Trip cost	Truck mile cost	Equivalent costs in cents per 100 pounds							
			30,000-lb. pay load with loaded operation		32,000-lb. pay load with loaded operation		34,000-lb. pay load with loaded operation		36,000-lb. pay load with loaded operation	
			100%	50%	100%	50%	100%	50%	100%	50%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Miles	Dollars	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1,000	177.65	17.8	59	118	55½	110½	52½	104	49½	98½
1,050	185 71	17.7	62	123½	58	115½	54½	109	51½	103
1,100	193.77	17.6	64½	130½	60½	122	57	115	54	108½
1,150	206.83	18.0	69	135½	64½	127½	61	120	57½	113
1,200	214.89	17.9	71½	141	67	132½	63	124½	59½	117½

Explanation of Columns Shown in Table

Col. 1 - Highway distance - miles

Col. 2 - Truck trip cost composed of:

Fixed expenses from carrier's profit and loss statement - per-vehicle fixed costs of $943 divided by average number of trips per vehicle of 146 trips gives $6.45 fixed cost.

Variable cost of 16.2 cents per mile operated or $4.03 per 25-mile block.

350 miles was considered the extent of 1 day's normal trip length, therefore an additional $5 covering driver's meals and lodging was added to each succeeding 350-mile block.

Col. 3 - Truck mile cost - Col. 2 divided by Col. 1.

Col. 4 - Cost per 100 pounds when loaded operation is 100 percent - trip cost divided by 30,000 pounds

Col. 5 - do. 50 percent - do. for twice distance divided by 30,000 pounds.

Col. 6 - do. 100 percent - do. divided by 32,000 pounds.

Col. 7 - do. 50 percent - do. for twice distance divided by 32,000 pounds.

Col. 8 - do. 100 percent - do. divided by 34,000 pounds.

Col. 9 - do. 50 percent - do. for twice distance divided by 34,000 pounds.

Col. 10 - do. 100 percent - do. divided by 36,000 pounds.

Col. 11 - do. 50 percent - do. for twice distance divided by 36,000 pounds.

Table 15.--Composite scoring of reasons for transporting grain by motortruck

Reason	First reason	Second reason	Third reason	Fourth reason	Fifth reason	Total
Better service	16	25	11	3	-	55
Lower rate	31	16	3	3	-	53
Boxcar shortage	17	8	8	3	3	39
Lower handling cost	1	9	13	-	1	24
Increase volume of grain shipped	10	5	-	-	-	15
Profit from trucking operation	8	4	2	-	-	14
Less labor and manpower regardless of cost	-	-	1	4	-	5
Lack of adequate storage facilities	-	1	1	-	-	2
Other reasons	5	7	4	-	1	17
Total choice	88	75	43	13	5	224

Table 16.--Schedule of capital and operating costs for various types of grain-unloading equipment

	Truck dump	Power shovel	Car dump
	Dollars	Dollars	Dollars
Original cost of equipment 1/ (including installation)	22,650.00	729.70	250,000.00
Depreciation (annual) 2/	3,775.00	72.97	12,500.00
Labor (per hour) 3/	1.26	5.04	5.05
Maintenance and power 4/ (per hour)	.215	.337	5/

1/ Information on cost of truck dump and power shovel furnished by manufacturers, and on the car dump by an elevator operator. Installed cost of car dump includes the provision of unloading shed, pits, and receiving legs in an existing elevator.

2/ Based on information provided by manufacturers and users of the equipment. Straight line method; annual rate: truck dump, 16-2/3 percent; power shovel, 10 percent; car dump, 5 percent.

3/ From table 8, $1.26 per man-hour times number of men employed.

4/ Information furnished manufacturer of truck dump and user of power shovel.

5/ Unable to obtain accurate data.

Table 17.--Estimated operating costs per bushel of grain handled and per hour of continuous operation for various types of unloading equipment at different levels of equipment utilization

Annual unloading capacity operated 1/	Hours operated annually	Truck dump			Power shovel			Car dump		
		Bushels handled annually 2/	Unloading cost Per hour 3/	Unloading cost Per bushel 4/	Bushels handled annually 2/	Unloading cost Per hour 3/	Unloading cost Per bushel 4/	Bushels handled annually 2/	Unloading cost Per hour 3/	Unloading cost Per bushel 4/
Percent		Thousands	Dollars	Cents	Thousands	Dollars	Cents	Thousands	Dollars	Cents
5	104	374	37.77	1.049	351	6.08	0.180	1,605	125.23	0.812
10	208	749	19.62	.545	702	5.73	.170	3,209	65.14	.422
15	312	1,123	13.57	.377	1,053	5.61	.166	4,814	45.10	.292
20	416	1,498	10.55	.293	1,404	5.55	.165	6,418	35.09	.227
25	520	1,872	8.73	.243	1,755	5.52	.164	8,023	29.07	.188
30	624	2,246	7.52	.209	2,106	5.49	.163	9,623	25.07	.163
35	728	2,621	6.66	.185	2,457	5.48	.162	11,232	22.21	.144
40	832	2,995	6.01	.167	2,808	5.47	.162	12,837	20.06	.130
45	936	3,370	5.51	.153	3,159	5.46	.162	14,442	18.39	.119
50	1,040	3,744	5.10	.142	3,510	5.45	.161	16,046	17.05	.111
55	1,144	4,118	4.78	.133	3,861	5.44	.161	17,651	15.97	.103
60	1,248	4,493	4.50	.125	4,212	5.44	.161	19,255	15.06	.098
65	1,352	4,867	4.27	.119	4,563	5.43	.161	20,860	14.29	.093
70	1,456	5,242	4.07	.113	4,914	5.43	.161	22,465	13.63	.088
75	1,560	5,616	3.90	.108	5,255	5.42	.161	24,069	13.05	.085

1/ 100 percent capacity operations equals 2,080 unloading hours per year (40 work hours per week by 52 weeks). Range of equipment use unlikely to exceed 75 percent of capacity operations, that is, according to the Northwestern Miller Almanack, 1951, flour milling operations in Texas and Oklahoma averaged approximately 72.5 percent of plant capacity in 1950.

2/ Bushels unloaded per hour from table 8.

Truck dump = 3,600 bushels per hour times column 2.

Power shovel = 3,375 bushels per hour times column 2.

Car dump = 15,429 bushels per hour times column 2.

3/ Cost per hour = annual depreciation ÷ column 2 plus labor, maintenance, and power. (See table 16, Appendix.)

4/ Cost per bushel = cost per hour ÷ number of bushels unloaded per hour.

Table 18.--Composite scoring of objections to transporting grain by truck according to choice

Objection	First reason	Second reason	Third reason	Fourth reason	Total
Unethical business practices	16	11	1	1	29
Disrupts existing marketing channels	11	7	1	-	19
Lack of transit privilege	7	2	2	1	12
Complicates rate structure	-	1	1	-	2
Difficulty of inspection and sampling	-	1	1	-	2
Increases billing and accounting	-	-	1	1	2
Total choice	34	22	7	3	66